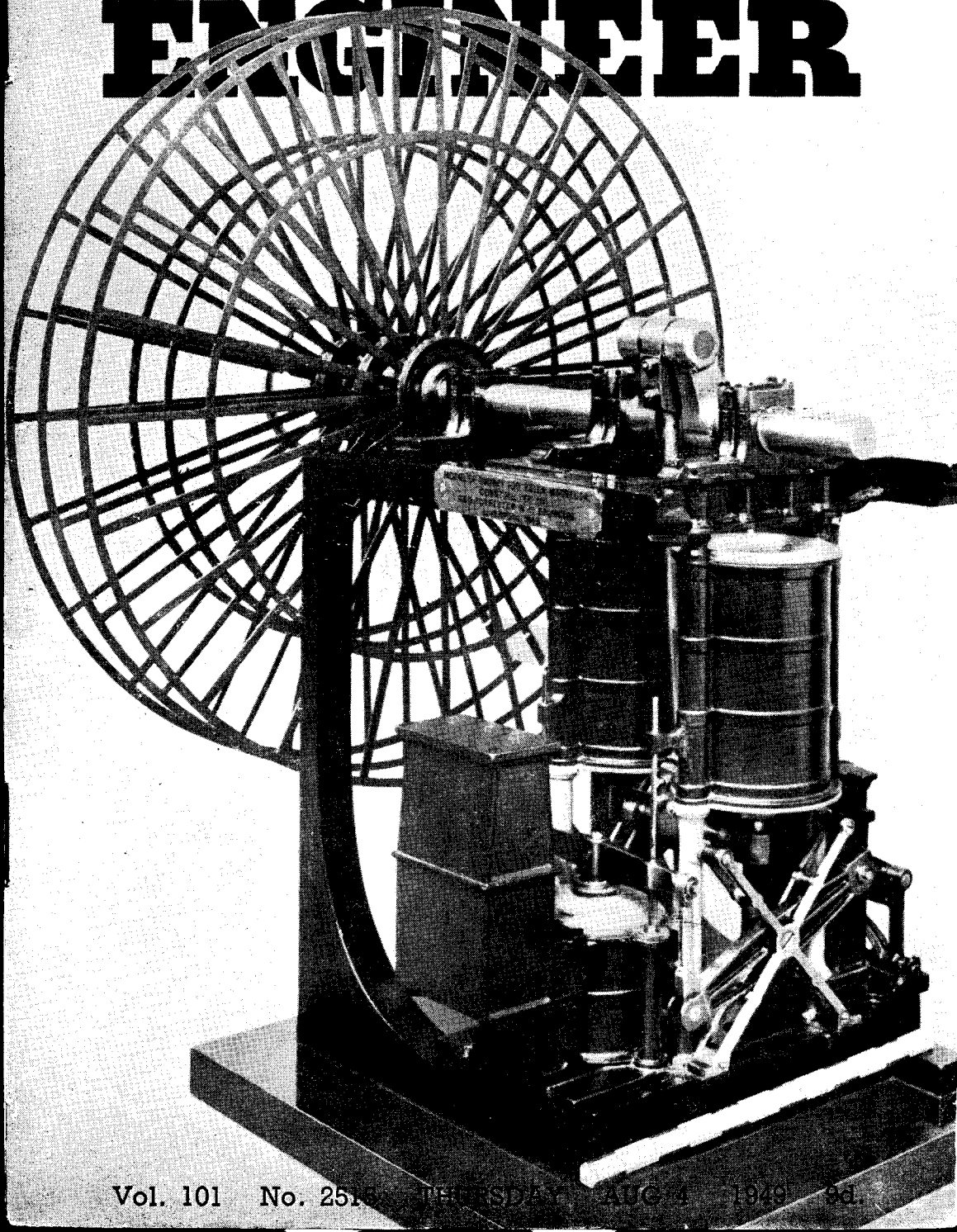
THE MODEL ENGINEER



Vol. 101 No. 2516 THURSDAY AUG 4 1949 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

4TH AUGUST 1949 VOL. 101 NO. 2515

SMOKE RINGS

Our Cover Picture

● WITH THE advent of steam power for marine propulsion, engineers were faced with many new problems, particularly in the matter of fitting the necessary machinery into spaces restricted in one or more dimensions. Some very interesting developments in design were thereby produced, including the early side-lever and oscillating engines and later, the diagonal engine, all of which were used for driving paddle wheels, prior to the introduction of the screw propeller.

The example shown on the cover is of the inverted cylinder type, being a true scale model of the machinery employed for propulsion in the paddle steamer *Helen McGregor*, built at Birkenhead by John Laird in 1843, for the Hull-Hamburg trade, the engines being constructed by Messrs. G. F. Forrester & Co.

It will be seen that the engine had two vertical cylinders, which were 42 in. bore by 53 in. stroke in the prototype, placed athwartships with the stuffing-boxes on the underside, at sufficient height to clear the crosshead at the top of the stroke. The crosshead formed a yoke connecting the two piston-rods, and was guided by a lever parallel motion. A long connecting-rod attached to the centre of the crosshead, and working in the space between the cylinders, transmitted power to the single crank on the paddle-wheel shaft, which ran in split bearings mounted on an entablature over the cylinders. Each cylinder had its individual slide-valve, but both were worked by a single eccentric; the details of the valve-operating gear are not visible in the photograph.

The condenser was located below the slide-valve chest, and connected by a passage in the foundation plate to the air-pump visible on the other side of the cylinders. This pump, which had a bore of 33½ in. and a stroke of 28½ in., was operated by links from the levers of the parallel motion, as also were the feed, bilge and brine pumps. Steam was supplied at a pressure of 3.75 lb. by tubular boilers, and drove the paddle wheels, which were 23 ft. 6 in. diameter, at 23½ revolutions per minute. It was estimated that this type of engine, with its boilers, effected a saving of 25 ft. in the length of the complete plant, compared with a side-lever engine and box boiler, as generally used at this period. (*Crown Copyright photograph. From an exhibit in the South Kensington Science Museum.*)

Notable Absentees

● WE KNOW that many visitors to the "M.E." Exhibition will be sorry to learn that neither "Uncle Jim" Crebbin nor Mr. V. B. Harrison will be present, this year. Both will be on holiday in Norway, a land where the people are kindly and astonishingly hospitable.

In these days, Continental trips are subject to a system of priority, and are practically impossible to fix up just when we would like.

We wish our two old friends a thoroughly restful and enjoyable time while they are away.

Slough's Annual Event

● THE ANNUAL model engineering exhibition organised under the auspices of the Slough and District Model Engineering Society, assisted by the Slough Model Aero Club and the Slough Radio Society, is being held at Agar's Plough, Windsor Road, until August 6th. The friendliness and general "get together" spirit, so much a feature of S. & D.M.E.S. functions, is showing itself once more, as we understand that entries are on show from the following societies: Staines, Harrow and Wembley, Ickenham, High Wycombe, Kodak, North London, Hayes, Malden, Aylesbury, Watford and Edgware.

The passenger-carrying track, on which all the usual gauges between 2½ in. and 7¼ in. are available, should provide a good run for the passengers, for it consists of the Slough, Kodak and Staines portable tracks joined in one long length.

The competition section is well worth inspection on account of the number and variety of the entries, and we think that all readers who can should make a special effort to visit the show.

Mr. J. A. Kay

● READERS WHO enjoy railway literature will, we know, share our regret at the passing of Mr. J. A. Kay, Deputy-Chairman and Managing Director of Transport (1910) Limited and Editor of *The Railway Gazette*. He died on July 8th, after an operation, aged 67.

We had enjoyed the privilege of his acquaintance for many years, and knew him as one who, throughout his life, had loved railways and everything connected with them; but what may not be so well known to our readers is that his brilliant journalistic career began, fifty-one years ago, on the editorial staff of *The Captain*, a popular boys' periodical, for which he looked after the model engineering section. He never lost his interest in our hobby, and was a close friend of the late Percival Marshall.

A somewhat austere and essentially reticent character, Mr. Kay possessed, nevertheless, a strong sense of humour and a keen wit. His was a lovable nature which won him a host of lifelong friends who feel that, with his passing, technical journalism has lost an outstanding personality who can never be wholly replaced.

Watford Club's New Track

● CHIPPERFIELD, A village near King's Langley, Herts, was the scene of a most enthusiastic gathering on Sunday, July 3rd, when the splendid new track built by the members of the Watford Model Engineering Society was formally opened by Mr. J. N. Maskelyne, Associate Editor, THE MODEL ENGINEER.

The track is installed in part of a large meadow belonging to the society's genial chairman, and is very well constructed. All the curves are transitional, the minimum radius being 90 ft.

It is about 1 ft. 6 in. above ground level and rests on timber battens fixed on cast concrete supports. Stout hooks at every joint anchor the rails to the main structure, but in such a way that the rails float, as it were, and so eliminate the distortion that occurs as the result of temperature changes. The complete circuit is 820 ft. long, and the gauges available are 2½ in., 3½ in. and 5 in.

The Watford Model Engineering Society extends an invitation to owners of suitable locomotives, to visit the track, taking their engines with them. Anybody wishing to take advantage of this offer is requested to get into touch with Mr. R. T. Blackman, 10, Strangeways, Watford, Herts.

Our experience of this new track is that it gives very steady, smooth and quiet riding, and the locomotives seem to be able to make the very best use of their tractive powers on it. It is the result of excellent team-work on the part of the members who have certainly done a good job of work that deserves all possible success.

Whose Launch?

● REGARDING OUR recent comment that "seldom do we raise a question that cannot be answered by some reader," Mr. R. Nicholes, of Hayes, Middlesex, wonders if anyone could help *him*.

He states that, while taking part in a picnic tea on the river bank just below Chertsey bridge, on Sunday, May 22nd. he sighted a *steam* launch. This, in itself, is unusual among the crackles and pops of outboards and other miscellaneous "poison gas" plants, as he puts it!

But Mr. Nicholes' attention was drawn particularly to the launch's funnel which he refers to as "a handsome brass spout with a noble flair, in real naval pinnace style, and could only be described by Mr. Hambleton." It was evidently the kind of funnel that would "go" with one of Stuart Turner's handsome triple-expansion engines. The question of the moment is: Can any reader identify the launch? Perhaps, the owner may even be a reader of the "M.E."; if so, we would be very pleased to hear from him.

What Use is it?

● A CORRESPONDENT, writing especially about model traction engines, raises the question as to whether such models can be put to some useful work other than merely hauling their owners plus a few delighted "children" of all ages! We are much inclined to think that work of the latter kind is not useless—far from it. But the question raised certainly seems to be worth further consideration. So far as traction engines are concerned, we have occasionally described and illustrated models of these which have been applied to such utilitarian purposes as working a circular saw for cutting logs, hauling loads of fruit, vegetables or refuse about the garden, or even hauling a roller up and down the village cricket pitch.

When it comes to other kinds of engines, such as portables, stationary engines and the like, what can they be given to do? Perhaps some readers can provide definite answers to that question; if so, we should be glad to receive illustrated descriptions of any applications of models to utilitarian duties, domestic or otherwise. And they need not concern only steam models; any kind of power-driven model may have possibilities in this direction.

WHAT TO SEE

AT THE 1949 "MODEL ENGINEER" EXHIBITION

Interesting Trade Exhibits

IT is encouraging to note that, in spite of the still-continuing difficulties in which we all endeavour to maintain existence, the model engineering industry is fully represented at this year's MODEL ENGINEER Exhibition, where the number of trade stands and the goods they display indicate steady progress.

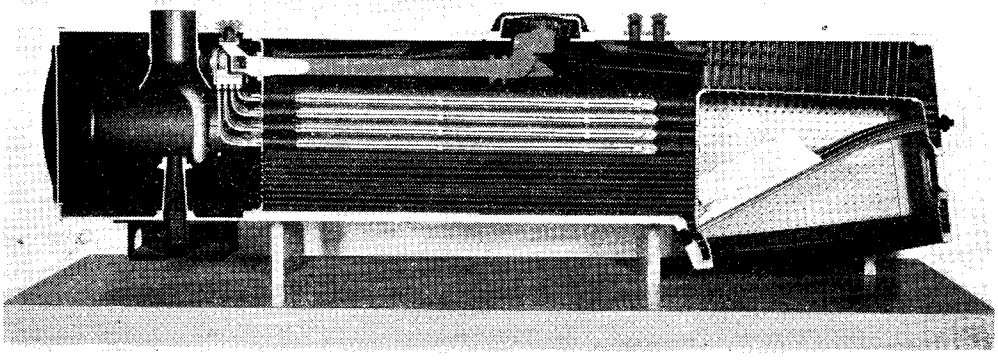
"Comparisons are invidious" say some; but the model engineer, seeking the best products and materials on which to spend hard-earned money, may not agree. In fact, the opportunity of comparing the quality and prices of goods displayed in the trade section of the exhibition is not the least of the attractions of the show.

It is refreshing to find that the tag "Discontinued for the duration" has now disappeared from the manufacturers' catalogues; indeed, we in the hobby are fortunate in not having too many "export only" labels attached to the equipment we want. The change from a sellers' market to a buyers' market has tested the ingenuity of the makers and dealers, and we think visitors will be pleasantly surprised at the variety and value offered this year.

In the space at our disposal, we cannot do justice to each and every exhibitor, but we append, in alphabetical order, a brief summary of each stand.

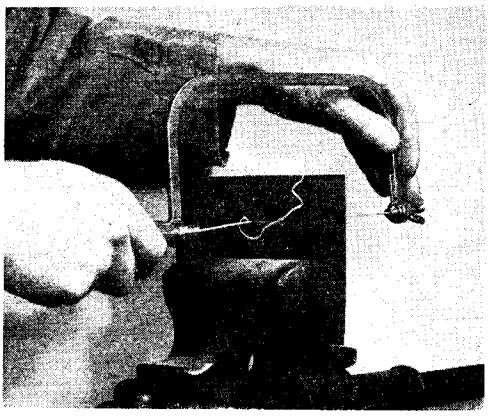
Abrasive Tools Ltd. The well-known "Abrafile" displayed on this stand is already used in innumerable model workshops, and its usefulness and efficiency are well proved. It consists of a specially treated steel wire on which are formed cutting teeth extending completely round the circumference, so that it can be used both as a file and as a saw, and it will cut in any direction. The teeth are non-clogging and cut cleanly in all metals. It can be held either in a hacksaw or fret-saw frame by using special adaptor links, but special "Abraframes" are available for 9-in. or 6-in. "Abrafiles." The provision of teeth all round the "Abrafile" not only enables it to cut in any direction without necessarily shifting the angle of the frame, but also gives considerably longer life as a fresh set of teeth is constantly being brought into action. Moreover, the round sectional blade is much more robust than a thin saw or file.

Acorn Machine Tool Co. (1936) Ltd. This stand features a wide range of machine tools and workshop equipment, including lathes of various types, shapers, milling machines, grinders and everything necessary for the home and professional workshop.



A 1/5-scale sectional model of the "Liberation" locomotive boiler, by Bassett-Lowke Ltd.

Adamcraft. The kits on this company's stand should be carefully examined. They include the sailing dinghy which is a real boat-builder's job, the 16-in. sharpie which is more suitable for the beginner, the 30-in cabin cruiser, and the 30-in. racing hydroplane. A cabin



The " Abrafile " in use

cruiser built from one of these kits has crossed from the Beaulieu river to the Isle of Wight and back in 1¾ hours under its own power. The scale model Perkins deisel engine in Perspex, enclosing an electric motor, and their 4-V electric motors, will also be shown.

Bassett-Lowke Ltd. This well-known and justly esteemed firm, will celebrate their jubilee year with a rather special display. The stand will incorporate a single " O "-gauge continuous track on which will be operated samples of the various electric models now available. In addition there will be " O "-gauge locomotives in clockwork and steam, passenger and goods rolling-stock, permanent way ready-laid as well as in parts, signals and other accessories.

Of particular interest will be a set of parts for the construction of the " Enterprise " 4-4-0 " O "-gauge steam locomotive. These will be completely finished ready for assembly, and the inexperienced beginner should be able to construct the model, entirely finished and painted, in 15 hours.

For the builder of larger steam locomotives, castings and boiler fittings for the 2½-in. gauge " Flying Scotsman," and castings, parts, drawings and an instruction booklet for a new design of 3½-in. gauge 0-6-0 tank locomotive will be shown. The latter model is being produced particularly for the beginner.

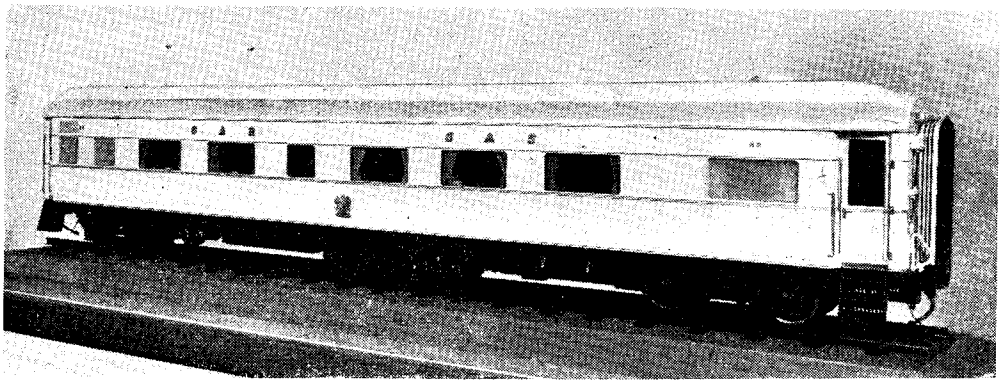
Castings for the ever-popular " Royal Scot," in 7½-in. and 10¼-in. gauges are once again obtainable, and samples of these will be on view.

In addition to model railway components, there will be many other items which will be of interest to model engineers generally, and will include examples of the firm's high-quality boiler fittings.

But, to old friends of this firm, the main interest is certainly to be centred upon the scale model of the new factory, for the building of which negotiations are now in hand. Other fascinating models will also be included.

Buck & Ryan Ltd. One of the oldest and most popular exhibitors, this firm is again staging a comprehensive display of hand tools, machine tools and every kind of equipment for the small workshop.

Cartwrights Model Supplies Ltd. A very wide range of constructional kits, materials and accessories for model railways, aircraft, ships and cars will be displayed on this stand. Also featured will be the Kalper 0.32 diesel engine for which this firm are the sole distributors. The weight of this engine is only 1½ oz. yet it is capable of 11,000 r.p.m. A model aircraft constructional kit which is certain to appeal to the growing band of scale model enthusiasts is that for the 1914/18 war fighter, the S.E.5, which is suitable for free-flight or control-line flying



A 1-in. scale replica of the King's saloon, South African Railways, by Bassett-Lowke Ltd.

Coronet Tool Co. The range of small lathes and machine tools exhibited by this firm includes the "Ruby" watch and clockmakers' lathe, which is capable of conversion to a precision drilling machine, the Coronet "Diamond" precision lathe, the "Home Cabinetmaker" universal combination lathe, and the Coronet "Major" combination woodworking, metal turning and spinning lathe.

E. W. Cowell. This firm is exhibiting, for the first time, a new sensitive drilling machine of ⅜ in. capacity. It can be supplied in various forms such as with a built-in countershaft fitted with cone friction clutch for use where electricity is not available, or individual drive not desirable for any reason; also without the countershaft for driving direct from an electric motor. The machines are also available as complete sets of castings and material for the home constructor. These have all the heavy or difficult machining operations, including gear-cutting, carried out so that the machine can be constructed with the aid of a lathe only.

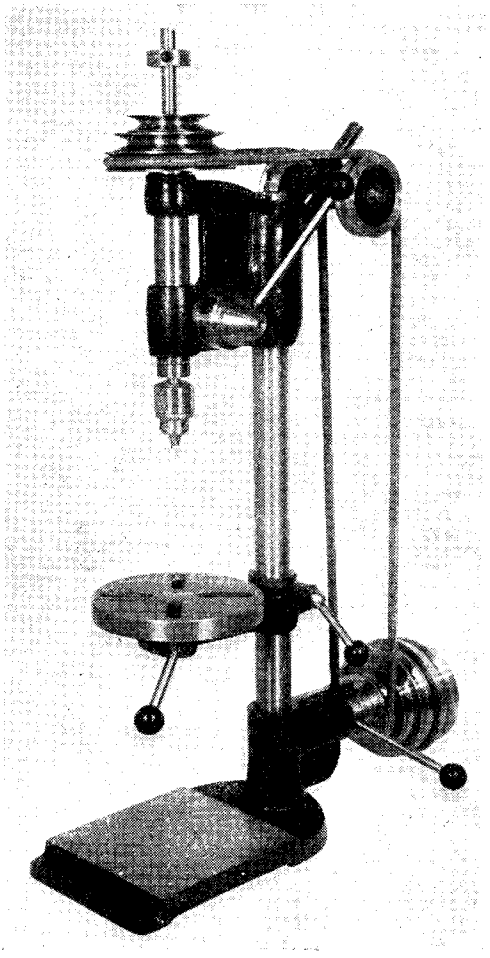
Craftsmanship Models Ltd. At the last two exhibitions, the stand of Messrs. Craftsmanship Models has been the attraction for model engineers interested in "something different." The show case exhibit in this year's exhibition still features the well-known specialities of this firm, including the "Craftsman Twin" 10 c.c. 2-stroke engine, the "Seal" 15 c.c. and "Seal Major" 30 c.c. 4-cylinder engines, together with several entirely new specialities. Among these are the "Ladybird" 2.5 c.c. vertical twin c.i. engine and the prototype castings for a new 10 c.c. vertical twin side-valve water-cooled petrol engine, the "Seagull," by the same designer. Camshafts and timing gears for the "Seal" and "Seal Major" engines are available and similar components for the "Seagull" engine will also be produced.

The parts for the "Miniauto" power unit for bicycles, including drawings and castings, are also displayed. This engine can be fitted to an ordinary bicycle, providing front wheel drive at speeds up to 20 m.p.h., and with a petrol consumption of 350 miles per gallon.

Other castings include the die-castings for the "Atom V" 30 c.c., "Cadet" 5 c.c., the "Cadet" gearbox unit and the "M.C.N." bevel drive unit, also the "Trojan" single-cylinder steam engine, one of the utility steam engines described recently in the MODEL ENGINEER. Various other castings and the well-known M.I. single and twin spark coils and magnets also feature in this exhibit.

Grahame Farish, Ltd., newcomers to the model railway industry, will be showing a "OO"-gauge L.M.S. Class 5 4-6-0 locomotive fitted with a motor which has been developed by a member of the firm's staff. On light load, the motor consumes less than 1 W, and when hauling four bogie coaches up a 1-in-20 grade, the consumption is only 2 W. Consequently, the locomotive can be economically run from batteries. It is arranged for 2-rail working, and the control gear, which also forms the battery case, has a direct reverse switch and a 4-position speed control, together with an electro-magnetic circuit-breaker.

Other interesting items will be: some 5-in. suburban coaches of non-bogie type, some wagons of various types and some covered vans and brake vans, all of which are fully detailed in relief.



Messrs. E. W. Cowell's sensitive drilling machine

Some simple, robust and pleasing "OO"-gauge track is also produced by this firm; it is of patented construction and may be curved to any desired form by removing a fibre web on one side, enabling the constructor to mount track just as he wishes without the inconvenience of individual assembly.

Hamblings, the specialists in "OO"-gauge model railway locomotives, rolling-stock and accessories, will be exhibiting a comprehensive selection of their well-known products. The stand will include a working 2-rail "OO"-gauge layout comprising double-track operation with passing loops automatically controlled so that one train can run into an unoccupied loop, stop, and then start the train waiting on the other loop. The control points for entering and leaving the loops are automatically set to accept the next train, so there is no possibility of there being a collision.

This firm has lately produced a very interesting and effective tool for pressing "OO"-gauge wheels on to axles. It incorporates a simple method of quartering driving wheels at the time of pressing, and should therefore be of great help in the construction of 4-mm. scale locomotives. Other items by this firm include kits of parts for building miniature signals, a large selection of process-insulated wheels and an entirely new range of excellent litho sheets for model buildings.

We note that the prices of all these goods are really modest.

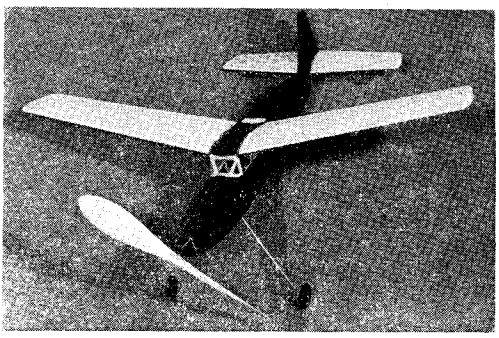
W. H. Haselgrove. The Haselgrove castings and model supplies are well-known to our readers, and hold a very high reputation. Some of the latest selections from this range will be exhibited, including castings for the "Duplex" back tool-post, the "M.E." universal swivelling vice, bench grinder and sensitive drilling machine.

Iliffe & Sons are the publishers of several technical books dealing with many subjects interesting to model engineers. They are also the proprietors of the popular journals *The Amateur Photographer*, *The Autocar*, *Flight*, *The Motor Cycle*, *The Wireless World* and *The Yachting World*, and the firm's stand will display all these.

J. & G. Jensen Ltd. This firm introduces, for the first time, an entirely new 10-c.c. 4-stroke o.h.v. petrol engine suitable for use in model boats, racing cars, or for other purposes. These engines are available in sets of parts or in complete form ready to run. The examples shown are for coil ignition, but a built-in magneto is also being developed for this engine.

Juneero Ltd. The well-known "Juneero" constructional kits as advertised in the MODEL ENGINEER will be demonstrated on this stand. Although intended principally for initiating juvenile craftsmen into the art of simple metal work, both the material and equipment of the "Juneero" outfit are capable of use in more advanced model engineering, and the "Juneero" combination tool for shearing, punching and bending strip and sheet metal has many useful applications in the model workshop.

E. Keil & Co. Ltd. This firm will again be showing their well-known Keilkraft model aircraft kits. The extensive range covers constructional kits for all types of model aircraft from simple beginners' gliders to large radio controlled power driven models. One new kit which will be certain to attract attention is the "Gipsy" 40-in. span Wakefield model. All kinds of materials and accessories for model aircraft and race cars will also be displayed. Specially featured will be the popular Mills diesel engines for which this firm are the sole distributors, and the new E.C.C. "Tele-Commander" radio control equipment.



Keilkraft's latest model, the "Gipsy," which is the cheapest Wakefield kit on the market

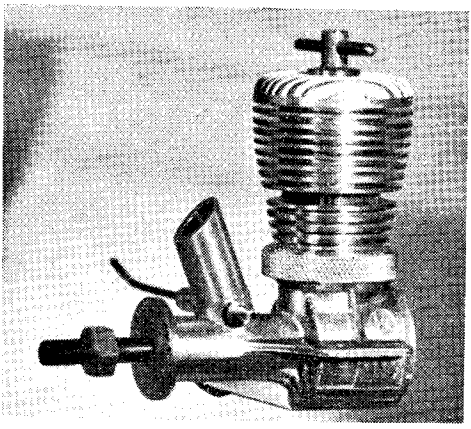
W. Kennedy Ltd. The main feature of this display is the "Kennedy Kwickie" tube bender which is available either in a complete form or in the form of a kit which can be made up by the model engineer and will thus form a useful addition to his workshop equipment. It is one of the lightest tube benders on the market and has no loose parts. A demonstration of tube bending will be given, also bending of various metal sections such as angle tees, channels, etc., and the bending of 1-in. × 3/32-in. mild-steel strip on edge without kinking or distortion.

Kennion Bros. (Hertford) Ltd. will be showing selections of their very wide range of castings for 2½-in., 3½-in., 5-in. and 7¼-in. gauge locomotives, nearly all of which are to designs by "L.B.S.C." Small injectors, pumps and lubricators are also included, as well as sets of blue-print drawings for any of the locomotives and other items.

The latest venture is a set of castings and parts for a well-proportioned horizontal steam engine. An engine built from these castings has already been illustrated in THE MODEL ENGINEER, and will be available for inspection at the exhibition.

"K." Model Engineering Co. Ltd., will display "K" model diesel engines from 0.2 to 5 c.c., including the 2 c.c. "Hawk" weighing only 1 oz., and claimed to be the smallest commercially made model diesel engine in the world. These engines will also be demonstrated in the Working Models Areas, where they will be seen in action fitted to speed and stunt control-line model aircraft and miniature race cars.

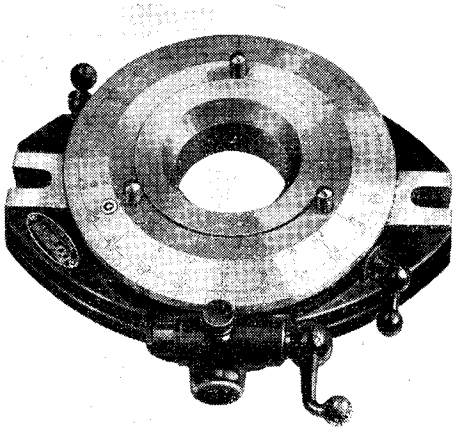
Magazines & Publications Ltd., publishers of *Mechanics*, will be showing selections of their range of blue-prints for small steam locomotives, yachts, etc., several interesting and useful technical books ; and there will be a display of photographs taken at many different functions held by clubs and societies.



One of the " K " range of compression-ignition engines

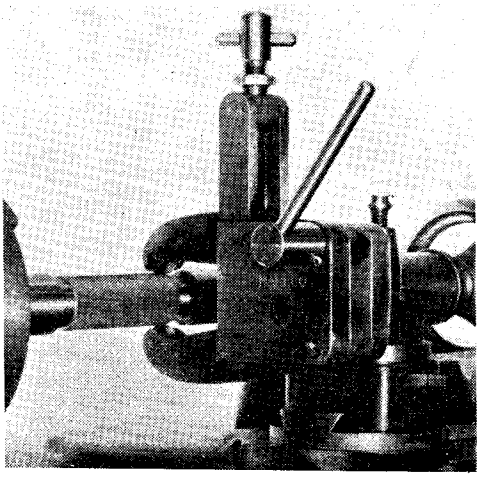
W. H. Marley & Co. Ltd. This firm specialises in machine tool accessories, attachments and components, applicable to the model engineering workshop or light production industry. The " Marlco " worm-operated angle-plate consists of a precision angle-plate having

The " Marlco " collet set



The " Marlco " dividing head

a table 10 in. × 8 in. and adjustable in angle within a range of 90 deg. clockwise and 30 deg. anti-clockwise. The dial is marked in degrees and the worm hand-wheel in increments of 5 minutes

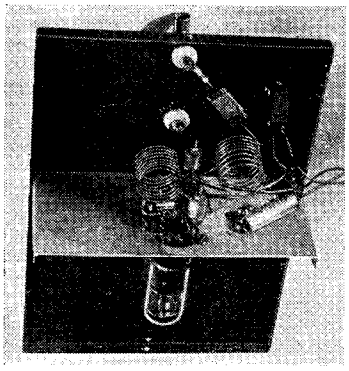


The " Marlco " knurling tool

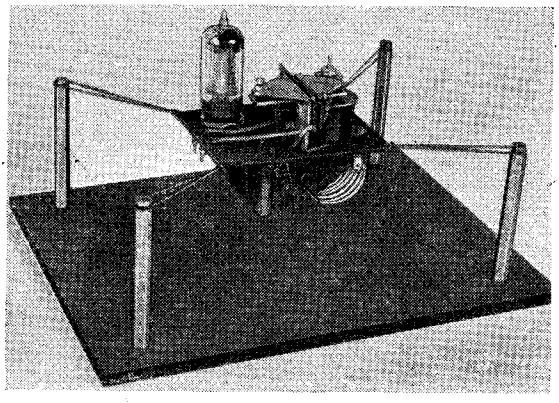
The " Marlco " indexing and dividing attachment is only 2 in. high and has a standard index plate with 24 notches. Special plates can be supplied with any number of notches up to 65. It can be supplied plain or fitted with a 5-in. chuck or a collet chuck for collets up to 1$\frac{3}{4}$ in. diameter and other mountings. A smaller version of the attachment, the " Marlco Minor " is also available.

Other items in this display include the " Marlco " all-purpose collet chuck and the " Marlco " angle collet fixture, thread-measuring parallels, keyway broaches, knurling tools, internal threading tools and taper bore gauges.

Percival Marshall & Co. Ltd., catering for every aspect of the model engineering hobby by publishing *The Model Engineer*, *The Model Railway News*, *Model Ships and Power Boats*, *Model Aircraft*, *The Model Car News* and a large number of really informative practical handbooks, useful drawings and the like, have a reputation that is unrivalled in the field of technical hobby literature. They will have a very comprehensive display of their well-known productions available for inspection, and no visitor to the "M.E." Exhibition should fail to acquaint himself, by actual investigation, with what is now available in the way of model engineering literature; for the situation is now very different from what it was even last year. And the range of Percival Marshall productions is being ever extended to meet constantly growing demands.



The Mercury-Cossor transmitter



The Mercury-Cossor receiver, showing the valve relay on top and the tuned circuit underneath the panel

Mercury Models Ltd. A full range of Mercury control-line model aircraft kits will be shown on this stand including the deBolt "Speed Waggon" (holder of the American World Speed Record of 163.13 m.p.h.), the deBolt "Super" Bipe" and the new Mercury stunt model, "The Monitor." Mercury fuels and control-line accessories will also be featured. Mercury-Cossor radio control equipment will be demonstrated in aircraft and marine models and the engines shown will include the AMCO 3.5 c.c., Elfin 1.8 and 2.49 c.c. and the E.D. range of diesels. The new Mercury-Allbon 1.49 c.c. glow-plug racing engine will attract the keen interest of speed enthusiasts.

Modelcraft Ltd. will be displaying numerous plans, planbooks, kits and accessories for the construction of model galleons, ships, yachts, power boats, railways, road transport, dolls' houses etc. This firm is also responsible for the publication of several elementary handbooks which are of use and interest to beginners and newcomers in the art of model making.

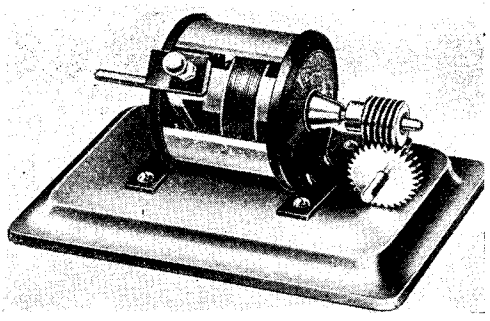
Models City (Wholesale) Ltd. cater primarily for model railways in all sizes from "OO"-gauge to Gauge "1." Locomotives, complete and in kit form, coaches, wagons, track, wheels, mechanism units, and signals are included.

Ships' fittings, aeroplane kits and fittings, a useful selection of glues and cements, certain electrical equipment including small motors, drawings and many other sundries will all be found here ready to be inspected and purchased.

Moore & Wright (Sheffield) Ltd. This firm needs no introduction to engineering craftsmen or other users of fine tools. Their well-known range of precision and hand tools will be displayed, comprising external, internal and special types of micrometers, steel squares, straight-edges, surfaces gauges, depth, screw-pitch and feeler gauges, calipers and dividers, automatic centre punches, chisels, screwdrivers, etc. The range of ratchet screwdrivers now includes a set of four for light duty from 1 in. to 4 in. in length, and the spiral ratchet screwdriver has been redesigned to allow parts to be replaced quickly and easily.

A number of lines suspended during the war have been reintroduced and new additions include a range of large size tubular frame micrometers. In addition to an improved model of the automatic centre punch, a new tool-makers' dotting punch will be available. This tool has been designed specially for use on small work where accuracy is essential.

Multi-Products Manufacturing Co. The small electric motors manufactured by this firm are of interesting design and have proved highly efficient. The "Multi" (Mark 5) is a suitable power unit for small gauge model railways and can be adapted either to driving models or for small industrial purposes. It operates from 12 V a.c. or d.c. with a consumption of $\frac{1}{2}$ to $\frac{3}{4}$ A. Component parts for this and other types of motors are also available, including rotor blanks, commutators, brushes and brush holders, wire for coils, motor boats, etc., also spur and worm reduction gears, reversing, starting and safety control switches and power transformers.



Messrs. Multi-Products geared motor unit

A unique item of the display is a motor claimed to be the smallest in the world, weighing only 3 grains or 1/160 oz., 20 motors will go into an ordinary thimble, and the motor is coil-energised and reversible.

Myford Engineering Co. Ltd. The Myford products are too well-known to our readers to call for a detailed description. The exhibits on this stand will include the well-known Myford "M" type 3½-in. lathe, the M.L.7 3½-in. lathe and the M.L.8 wood-working lathe, together with a range of attachments and accessories. A specially interesting feature of the M.L.8 lathe is the way in which it can be adapted to carry out nearly all types of woodworking operations, including circular sawing, planing and sanding, in addition to turning. An entirely new accessory, exhibited for the first time, is the Myford quick-setting lathe tool, which was described in detail some weeks ago in THE MODEL ENGINEER. This tool, which is available in complete sets for all turning operations, is used in conjunction with a special packing-piece, which enables the point of the tool to be tilted upwards or downwards within a limited angle, and this avoids the need for packing of varied thickness. It combines all the facility and convenience of the lantern type of tool-post with the rigidity and adaptability of the open-clamp form of tool-post. Demonstrations of Myford equipment will be given throughout the exhibition, and practical advice given to all users or prospective users of lathes.

George Newnes Ltd., publishers of technical literature and periodicals, will be displaying copies of their publications. Perhaps, the best known of these is the weekly journal, *Practical Engineering*, which publishes profusely-illustrated articles dealing with every aspect of modern engineering and covers such subjects as plastics, welding, die-casting, sheet metal work, machine tools, heat treatment and every kind of industrial process.

Henry J. Nicholls Ltd. On their stand this well-known firm will have a very comprehensive display of all the popular proprietary brands of model aircraft kits, engines and accessories. Control line and radio control equipment will be specially featured.

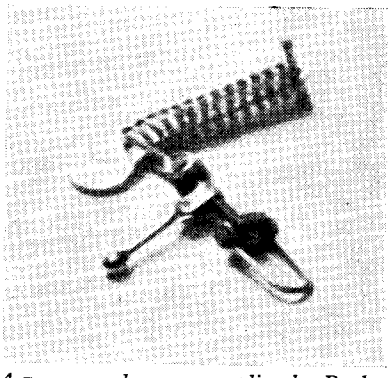
An electric motor construction set, by Multi-Products Mfg. Co.

W. G. Norcutt & Co. (London) Ltd. The Asgard arc welding outfit featured in this exhibit can be used to carry out welding on almost any metal up to a thickness of 1 1/16 in. It can be operated from 6-volt or 12-volt batteries, and it is claimed that no harm is done to the battery on jobs of short duration, provided that it is in good condition and kept fully charged. The Asgard welding kit is sold at a low price complete with welding tool, cable, carbons, cleaning compound, welding fluxes, filler-rods, dark goggles and instruction book.

Pools Tool Co. This firm, a regular and popular exhibitor before the war, had an excellent reputation for small lathes, milling machines and other machine tool equipment. Many of our readers will welcome their return to the exhibition, and in particular the revival of the well-known Pool bench milling machine which is featured in this exhibit. This machine is arranged for bench mounting, and can be supplied with either flat or vee-belt drive. It is one of the handiest and most versatile machines for the class of work required in model engineering.

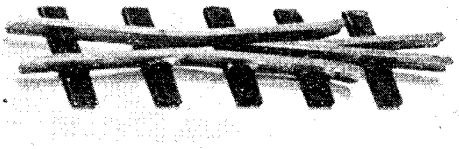
The Rawlplug Co. Ltd. This firm is well-known for their specialities in fixing devices of all kinds. "Rawlplugs" are so well known as to call for no description, and much the same applies to the "Rawlplug" metal expansion bolts for fixing motors and machines to concrete floors. "Rawlanchors," "Rawltoggles" and "Rawlnuts" are ingenious devices for fixing to thin or hollow materials. "Durofix" and "Duroglue" are adhesives of established merit, and other items in this department include iron cement, heatless solder and plastic wood. The tools exhibited on this stand include hand and electric percussion boring tools for brick and similar materials, electric soldering irons, super-scrapers, tool sharpeners, etc.

A. F. Richmond. This exhibit consists of machine tool accessories, including four vertical slides, one of which is of the heavy duty type with taper 5 in by 4½ in. The others are of a lighter type, one having a flat base table 4 in. × 4 in. another with a stepped base table of the same size, and the remaining slide of the swivelling type; also a 4-in. rotary table fully graduated over 360 deg.



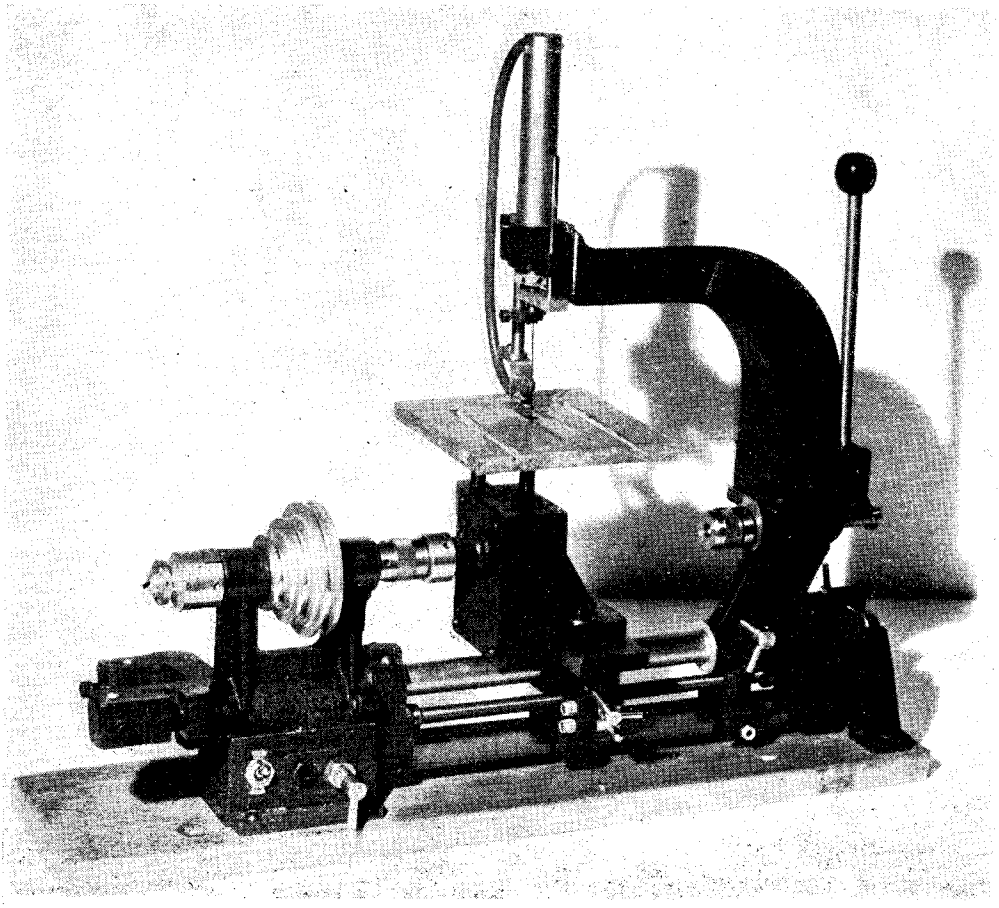
A 7-mm. scale screw-coupling by Rocket Precision Ltd.

Rocket Precision Ltd., specialists in 7-mm. scale model railways will have an interesting stand on which will be seen a number of 7-mm. scale locomotives which really are true to scale in all external features. They exemplify the ideals of the meticulous enthusiast who wishes his models to be exact portraits of their prototypes, whether they are ancient or modern. To meet the demand for working models in this category, the firm's " Scaloh " electric mechanism was specially designed, and is a very robust little unit that will give maximum power in the minimum space.



A 7-mm. scale frog for railway points by Rocket Precision Ltd.

" Scaloh " track parts and all the many other accessories which are produced by this firm are of the same high degree of accuracy and pleasing



The " Versatyle " multi-purpose machine tool

appearance, and belie the idea that a model railway cannot be made to scale without sacrificing strength. And the cost is not unreasonable.

Dick Simmonds is a name that needs no introduction to the "Live Steam" fraternity, for his castings for small steam locomotives are known all over the country and in many places abroad. The latest railway locomotive brought out by this firm is the neat 5-in. gauge 0-4-0 tank "Ajax," so different from its 3½-in. gauge namesake of fifty years ago.

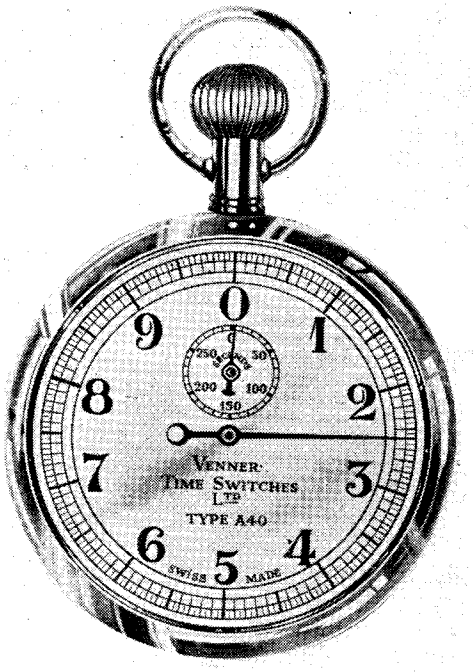
But this firm has a new venture in the form of drawings and castings for a 2-in. scale replica of a Burrell Scenic Showman's Road Locomotive to be known as *Thetford Town*. All the details for this magnificent engine have been worked out in collaboration with Mr. R. H. Clark, an authority on traction engines.

Slater, Frost & Gates (Engineers). There have been many attempts to produce a universal machine tool, but while some of these have been highly ingenious and successful in most respects, such machines are usually bulky and very expensive. In the "Versatyle" multi-purpose machine exhibited on this stand, these problems have been skilfully handled, with the result that a machine of handy size and wide utility has been produced at a moderate price. It is capable of performing several types of operations which would normally need at least four machines. Turning, drilling, jig-sawing, grinding, sanding, circular sawing and polishing can be carried out with equal facility. In situations where space is limited, the ability to turn out a very wide range of work on a single machine will be found particularly valuable. Demonstrations of the machine in all its various poses and applications will be be given at this stand.

Stewart-Reidpath Ltd., specialists in model railways in "OO" and "EM" gauges will be exhibiting a small model railway layout specially arranged to demonstrate the capabilities of the "ESSAR" mechanism. This unit was specifically designed for 4-mm. scale steam-outline locomotives and has now been adapted to meet the needs of the model railway owner who prefers to run his 4-mm. scale models on 18-mm. ("EM") gauge track. The unit can be supplied for either two-rail or three-rail current collection, as required; it can be fitted with wheels set to spacings which cover almost all the normal wheel arrangements, and the available driving wheels for it are: 17, 18, 20, 21, 23, 24 and 26 mm. diameter on tread. For its size, the unit, which is normally wound for 12 V d.c. supply, is very powerful and efficient.

The Admiralty. The Admiralty stand will contain, in addition to the leaflets relating to naval recruiting, a number of models of ships which should be of interest to ship modellers. A series of drawings for waterline models of various types of naval ships, drawn to a scale of 50 ft.-1 in., has recently been made available to the shipmodeller, and specimens of these will be on view.

S. Tyzack & Son, Ltd. The return of this well-known firm, a regular exhibitor in pre-war days, will be welcomed by many tool users. Their display will include all types of workshop equipment for the home and professional workshop including, in addition to the usual range of hand tools, several of the most up-to-date machine tools and accessories. A special feature in machine tools is the new "Zyto" 3⅜ in. sliding, surface and screw-cutting lathe, which will be demonstrated on this stand for the first time. This is a high-grade lathe at a low price to suit the pocket of the model engineer. It can be supplied as a bench lathe or complete on stand and suitably motorised. The "Myford" M.L.7 metal turning lathe and the M.L.8 wood turning lathe will also be shown, together with the 4½-in. "Boxford" lathe, also drilling machines, electric drills, etc.

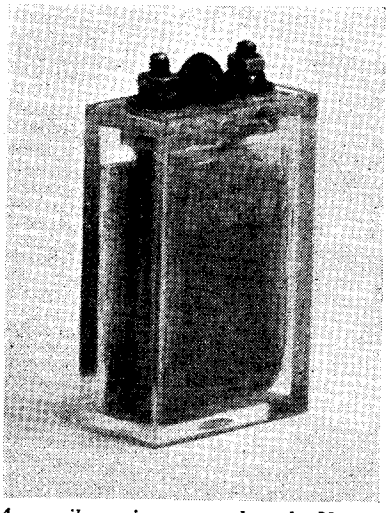


The Venner stop-watch

Venner Time Switches Ltd. In addition to the various types of time switches on which the main business of this firm has been built, they have also established a reputation for the production of electric instruments and small mechanical appliances, selections of which will be found of great interest to the model engineer.

These include the new "Venner" stop-watch, and a range of small high-torque synchronous motor movements which can be devoted to various purposes, including time recording mechanisms. These movements can be supplied with gearing giving a final drive from one revolution in eight seconds to one revolution in four hours. An entirely new departure is the

"Venner" light-weight alkaline accumulator which is suitable for driving all small electrical appliances and working models which require light-weight batteries. These accumulators are



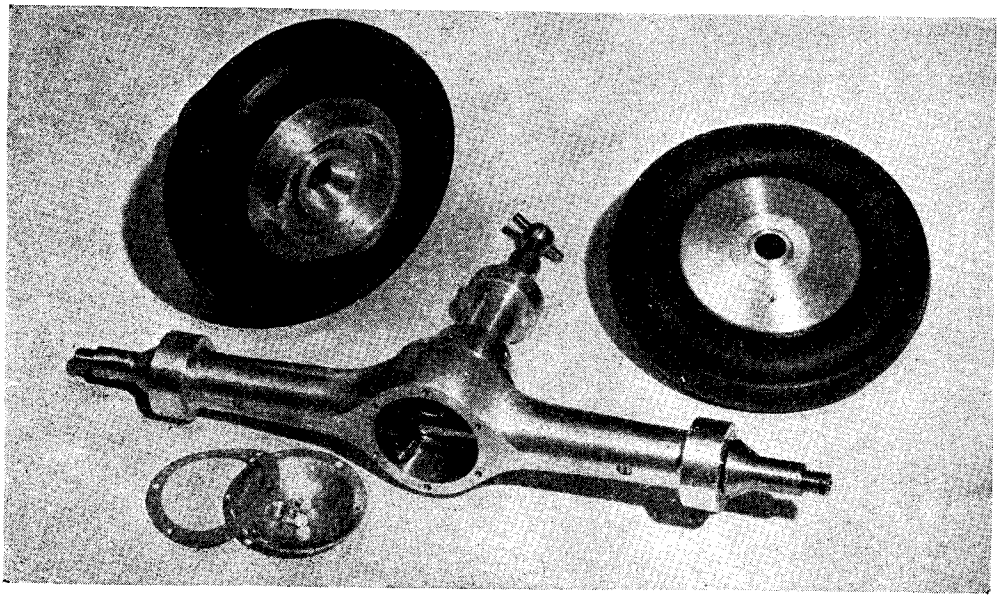
A new silver-zinc accumulator by Venner Time Switches Ltd.

of the silver-zinc type, giving 1.5 V per cell, and they are approximately one-third the weight and half the size of the normal lead-acid battery of similar capacity. They are nonspillable, durable and robust.

Walkers & Holtzapffel (Retail) Ltd. is another well-known firm catering for the model railway enthusiast. "OO"- and "O"-gauge locomotives, track, coaches, wagons, vans, signals, lineside buildings and other accessories will here be seen in profusion. "Romford" mechanisms and Riemsdyk flywheel drive mechanisms will be exhibited and demonstrated; each has its special features and is well worth close examination by everybody interested in the design, construction and performance of small mechanisms of this kind.

W. P. Small Power Units are manufacturers of hand-pumps, flexible couplings, special valve-gear for steam engines, valves and other items of use and interest to mechanical engineers. The Warren "L" type valveless self-priming positive rotary pump is a unit that can be applied to a number of uses. It possesses several unique features of which the combination of simplicity with self-compensation for wear is, perhaps, the most interesting.

Z.N. Motors Ltd., are well known to model enthusiasts, especially to those of the fraternity who build and run miniature racing cars. In their showcases this year will be seen a most complete array of component parts suitable for cars from 2.5 to 10 c.c., including pneumatic wheels ranging from $2\frac{1}{2}$ in.-4 in. o.d.; axle units for clutch and push start; spur-geared axle units; clutches and flywheels; coils, condensers and engine parts for the new Z.N. 2.5 and 10 c.c. engines; also spares and component parts for the full range of Z.N. products. They will also be showing their excellent range of aero wheels in sizes from 2 in.-6 in. diameter.



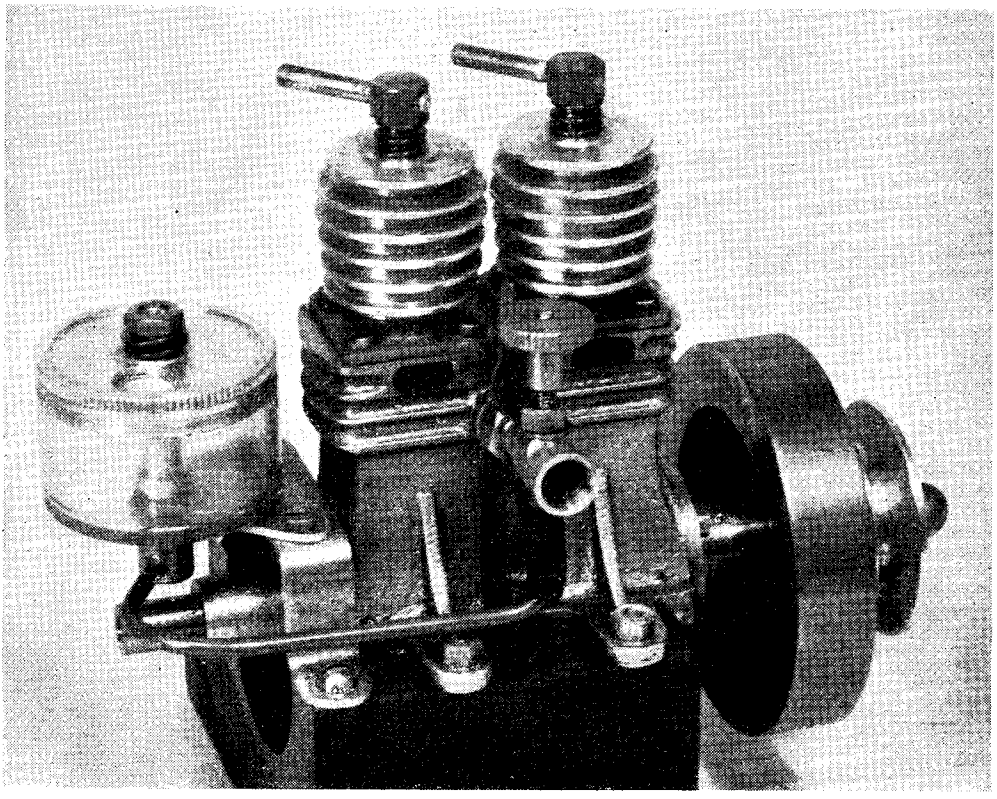
The clutch-type drive axle, with back plate removed, and special driving wheels manufactured by Z.N. Motors Ltd.

PETROL ENGINE TOPICS

*A Twin-Cylinder 2.5 c.c. Compression-Ignition Engine

by Edgar T. Westbury

THE blind-ended cap nut for securing the flywheel, seen in the general arrangement drawing, is of course an optional feature, and has not therefore been illustrated in detail. If the engine is used to drive a boat, the nut may be combined with a slotted coupling member to mate with the usual ball and pin joint on the same end. It is, however, practicable (though not strictly ethical according to full-size practice) to drive from the other end of the crankshaft; and the engine will run equally well in either direction, so there is a wide choice in this respect. One thing, however, that I do not recommend on any high-duty engine is taking the drive from a



A view of the complete engine from the carburettor side

propeller shaft, or any other type of coupling may be used. It should be noted that where the drive is taken through a screw thread in this way, the direction of rotation, in conjunction with the " hand " of the thread, must be arranged so that the torque tends to tighten up the thread. That is to say, if a right-hand thread is used, and the drive taken from the flywheel end, the latter must rotate anti-clockwise, viewed from the coupling held on the shaft by a grub screw; if one desires to use a coupling which will drive equally well in either direction, a sunk key should be fitted. It may be observed that screwed couplings are perhaps the most satisfactory of all in practice, provided that they are properly arranged and fitted.

The fact that a flywheel is specified for this engine does not in any way imply that it is unsuited for use as an aircraft engine, with an airscrew fitted instead of a flywheel. As a matter of fact, there is much to commend this

*Continued from page 71, " M.E.," July 21, 1949.

type of engine for aircraft use, and it is quite a simple matter to substitute an airscrew hub for the flywheel; it should preferably be made of mild steel, with a flange and loose washer not less than $\frac{3}{4}$ in. diameter, and taper-bored to fit over the split collet in the same way as the flywheel.

Pistons

These should preferably be made in close-grained cast-iron, by methods which have been described previously for other small engines. It will be seen that the inside is end-milled to form the gudgeon pin bosses, and this operation, also the drilling and reaming of the cross-holes should be carried out before finishing the outside diameter. The latter should be left about 0.002 in. oversize, and finished with a copper or aluminium ring lap, split and held in a carrier or die holder. All this work may be done before parting off the piston from the piece of cast iron stick, and this may include the machining of the deflector, by setting over the work so that its running centre is approximately on the edge of the diameter, and immediately over the gudgeon pin hole. Alternatively, the deflector may be shaped by filing if desired.

The same sequence of lapping as for the cylinder bores should be adopted, and the same care is necessary to ensure accuracy and high finish. Remember that "tightness" in the sense of producing a good seal is not synonymous with working friction; a piston which requires great force to move it through the cylinder is not necessarily gastight. If, however, due care and patience are exercised in the lapping operations, even a novice can produce an accurate result—as indeed, many have done so to my knowledge — whereas cocksureness or undue haste may result in failure.

Contra-pistons

These may be made of cast-iron or steel, and may be turned, drilled and tapped, and parted off in one operation. The object of tapping the inside is to enable the component to be held on a screwed chucking rod for lapping it to fit the cylinder bore, also for removing it for engine overhaul. This is a matter which is generally neglected, and I know of cases where great difficulty has been experienced in extracting pistons and contra-pistons. One constructor, confronted with a mild piston seizure, had to drift both these components through the full length of the bore, with the result that a long score-mark, and a permanent compression leak, was produced.

It is unusual to groove the contra-piston, but I have found that this helps to hold an oil seal, and reduces the amount of surface to be lapped. The contra-pistons should be fitted tighter than the main pistons, requiring a fair amount of force to shift them in the cylinder. Too easy a fit may not cause serious leakage, but may produce an objectionable rattle, and the compression adjusting screws may persistently slacken off after being set.

Gudgeon Pins

These may be made of mild steel and subsequently case-hardened, or of silver-steel, unhardened, the former being preferable. They are made a little shorter than the cylinder bore, rounded slightly on the ends and drilled through the centre. It is advisable to fit them a light press fit in the pistons, and to avoid the necessity of fitting soft pads to prevent them scoring the cylinder if they move endwise, a film of soft-solder may be applied with a soldering bit to the end faces when in position, and filed flush with the piston. The running surface of the pins should be a smooth fit in the eyes of the rods, and highly polished.

Connecting-rods

I invariably advise the fitting of a dummy connecting-rod in small i.c. engines, a policy which is often criticised as "unnecessary if the engine has been constructed to correct dimensions," but I find that it is the rule rather than the exception for small errors in the machining or location of ports to creep in despite the utmost care, and the precaution of making a temporary rod to check up on these errors is well worth while, and may save a good many hours of wasted effort in making finished rods which prove on assembly to be too long or too short. It is only necessary to make one dummy rod, for checking up on both cylinders.

The upper part of the rods shown can be machined between centres, the recommended material being duralumin or other high tensile light alloy. A robust section is allowed, in view of the heavy stress encountered in c.i. engines, the mass of metal in the rod affording a measure of resiliency and shock absorption which is a useful asset. It is frequently stated that light alloy rods are not satisfactory in c.i. engines, but weight for weight, they are, if anything, stronger than steel rods, and the latter must either be case-hardened or bushed at the eyes to give reasonable wearing properties. However, the constructor may exercise his own judgment in the choice of material.

After turning the spherical top end of the rod, and the tapered shank, the lower end should be machined or filed parallel, to a width of 7/32 in. for fitting the strap. The lower end should be faced off square, and to the correct length from the centre of the little end eye, as checked from the dummy rod. A piece of material should then be prepared for making the strap, the first operation on which is the formation of the slot, by careful milling or filing, to fit neatly over the sides of the rod. It is advisable to leave plenty of metal on the outside at first, and reduce it to size after the essential machining is completed. The strap is then fitted in place and the cross-holes drilled, after which it is temporarily secured by $\frac{1}{16}$ in. or 10-B.A. bolts. File the end faces flush, though they should still be left over finished width, and mark out the eye centre exactly on the intersection line of the rod and strap.

It is now necessary to set up the rod for boring the two eyes, and the method which I have previously described in dealing with engine construction, namely, clamping the rod, with suitable packing, to a flat steel plate which can be shifted on the lathe face-plate, will be found

useful in this case also. Centre the big end, drill it undersize and bore out; this is advisable, as the drill will probably run out of truth in drilling on the junction line of the two parts. At the same setting, the face can be machined, and the surface relieved above the bearing. The little end is then brought to centre position, and it should be possible, after centre-drilling, to drill and ream this truly without the need for boring, which would call for a very tiny boring tool, as the finished size of the hole is only 3/32 in. The reverse side of the big end bearing may be faced by mounting it *lightly* on a pin mandrel, taking care not to strain the strap bolts, and if necessary a driving dog of some kind may be improvised, such as by a temporary gudgeon pin in the little end, to engage against the chuck jaws.

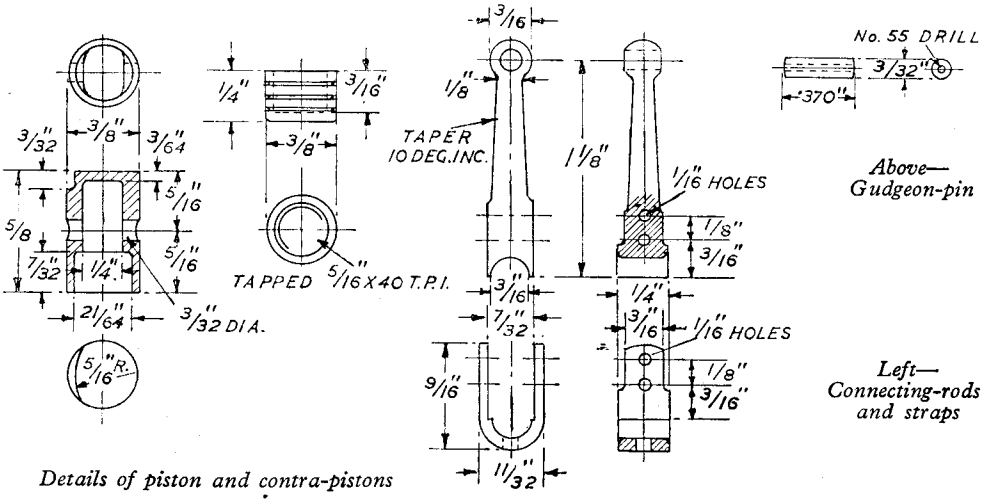
Some constructors may attempt to simplify the big end construction, by using a bent metal strap, but having tried this and found it wanting, I regard it as an example of the sort of short cut which leads only up the garden path. Apart from the fact that bending duralumin is always a somewhat risky undertaking in the absence of proper heat treatment facilities, it is difficult to obtain really good accuracy of the bearing surfaces, and reaming out after fitting may weaken the strap.

There is not over-much room for the big ends in the crank chambers, and it will be found necessary to pare them pretty fine, also avoid projecting rivet heads on final assembly; but if carefully carried out, the big ends will be quite secure—safer, in fact, than most split bearings of the orthodox type.

Cylinder Bonnets

Die castings are provided for these with extensions to form chucking pieces, which require only a mere skim externally, but it is quite easy to machine them right out from light alloy rod. If the internal threads are formed with a tap, it is desirable to undercut a clearance at the end of the main bore, sufficiently wide to enable the tap to clear itself, but the depth, if undercut, should be kept to the bare minimum to avoid weakening the wall unduly at this point. The smaller hole for the compression-adjusting screw may also be drilled and tapped at the same setting, and the bonnet then parted off.

The six holes, in the top fin, are for the purpose of screwing the bonnet up with a pin spanner. They were not provided in my prototype engine, and the bonnets had to be tightened or slackened with a pair of pipe-grips with fibre pads in the jaws; but this is not a very workmanlike method, and always entails some risk of marring the finish of the fins. Note that the bonnets do not necessarily have to make a gas-tight joint on the end of the cylinder liner, but should seat firmly home against it for security and correct location.



Details of piston and contra-pistons

Compression Adjusting Screws

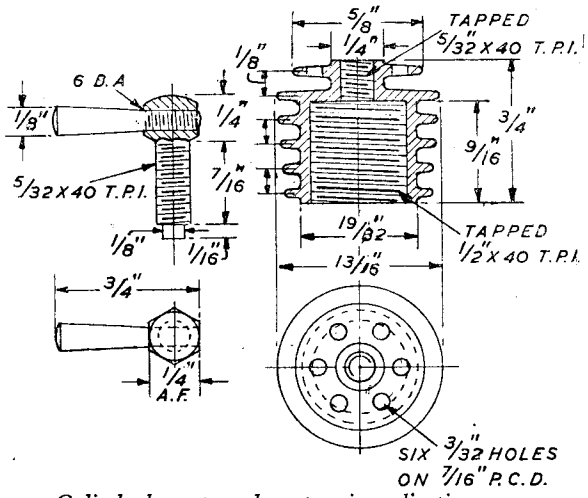
These are made of steel, and in the form shown, are in two parts, the handle being screwed into a cross hole in the head, which is made of hexagonal or square material for convenience in cross drilling; as an alternative, they may be made in one piece, the handle being of reduced diameter and tapered, so that it can be bent almost to a right angle after machining. The shank should be screwed home in a tapped block for this operation, to avoid bruising or distorting it.

In either case, the threads on the shank should be a good fit in those in the cylinder bonnet; a sloppy thread will result in the adjustment shaking loose under vibration. The fitting of short and fairly stiff springs under the heads of the screws will help to cure this, and is a useful safeguard even when the screws are well fitted.

Many readers have asked "Isn't it difficult to adjust the two compression screws so that both the cylinders fire evenly?" As a matter of fact, no particular difficulty in this respect has been encountered; once the settings for starting and running respectively have been found, they can be held fairly closely, but should either cylinder be out of adjustment, the sound of the engine and the appearance of the exhaust will

indicate the need for readjustment. There is far too much "knob-twiddling" on small c.i. engines, and after watching the antics of many users in attempting to start and run these engines, I sometimes think they haven't a clue to the effect and proper use of these adjustments.

If, however, it should be desired to "synchronise" the compression screws (the term is all wrong, really, but generally understood) there are several ways in which this could be done. The simplest way would be to equip the handles of the screws with a link, like the drain taps of a locomotive cylinder, so that they move in unison. This would necessitate initial adjustment of the length of the screws so that the handles were at the same angle when the compression was equal in each cylinder. Another way would be to fit small spur gears to the screws, and provide a central gear, with a milled head, to mesh with both of them simultaneously; or a horizontal shaft with worms to mesh with both gears. These devices would provide for initial independent adjustment before linking up the screws; they were all envisaged in the preparation of the design, but, as I say, I have not found them necessary, and as most readers will agree, complication which confers no practical advantage is simply bad design.



Cylinder bonnets and compression adjusting-screws

Carburettor

There is little need to describe this in minute detail, as it follows principles and methods of construction which have often been described in connection with small petrol engines as previously discussed. The dimensions are, of course, smaller than usual, and the turning and concentric drilling of the jet tube will call for some care, and the highest lathe-speed obtainable unless a contra-rotating drill spindle is available.

A stainless steel jet needle is advisable, but if this material cannot be obtained, and it is necessary to revert to brass or german silver, it is often found that the needle soon becomes ridged in closing down on the sharp edge of the orifice in the jet tube. As this seriously interferes with fine adjustment, and is in fact often the unsuspected cause of erratic running, it should be avoided if possible. I have found it desirable to make a small silver steel D-bit, pointed to the same taper as the jet needle, to form an accurate seating in the mouth of the orifice in the jet tube. Don't overdo this—a mere twirl of the D-bit between the thumb and finger is all that is necessary.

Small c.i. engines are not usually provided with any means of air control, but I have always found this to be useful for easy starting and adjusting speed, so although I did not use it on the first engine, I have provided for it in the drawings, and the die casting for the carburettor has a lug to take the air-shutter pivot screw. Constructors can therefore please themselves whether they use it or not.

With regard to the fuel supply, any form of fuel tank may be fitted, and there is a wide choice as to its location. It is a little difficult, though not impossible to fit the common type of bowl reservoir directly below the jet, so as to eliminate the need for a feed pipe line. The position of the tank shown in the photographs, mounted immediately over the end of the shaft, on a sheet metal bracket attached to the bearers, is both neat in appearance and satisfactory in use. I recommend fitting the tank with its mean centre line round about the same height as that of the carburettor, which avoids the effects both of appreciable gravity head and suction lift. The feed line should preferably be a metal pipe, with a sleeve coupling of synthetic rubber (Neoprene) or p.v.c. tube connecting it to the base of the jet. I do not approve of an entirely flexible pipe line, which wags bodily under vibration and may cause air locks or frothing of the fuel.

Incidentally, the tank shown was machined from solid perspex, with a duralumin lid held in place by a hollow bolt of the same material, having an elbow pipe joint at the bottom and a nut and spring washer at the top. The lid is composed of two discs with holes for the entry of fuel, the upper one being knurled on the edge and capable of rotation to close the orifice. A groove is cut in the lower disc to form an air vent. It is possible to equip this reservoir with a fuel cut-off valve, in the centre of the hollow bolt, either of the screw-down type, or having a trip device for use as a stopping switch. Should readers require further details of such devices they will be forthcoming, but most constructors have sufficient ingenuity to fix these things up for themselves.

Assembly

There is little in this that calls for comment, as everything should go together quite easily, and without the need for delicate fitting. In assembling the crankshaft, the split centre bearing should first be put in position and the screws

firmly tightened, making certain that the shaft runs freely; the two connecting rods are then assembled on the pins and the straps riveted on, again making certain they are a free running fit. Then invert the engine body and drop the rods through the bores; thread the end bearing housings on the crankshaft and secure them temporarily by the two screws into the engine body.

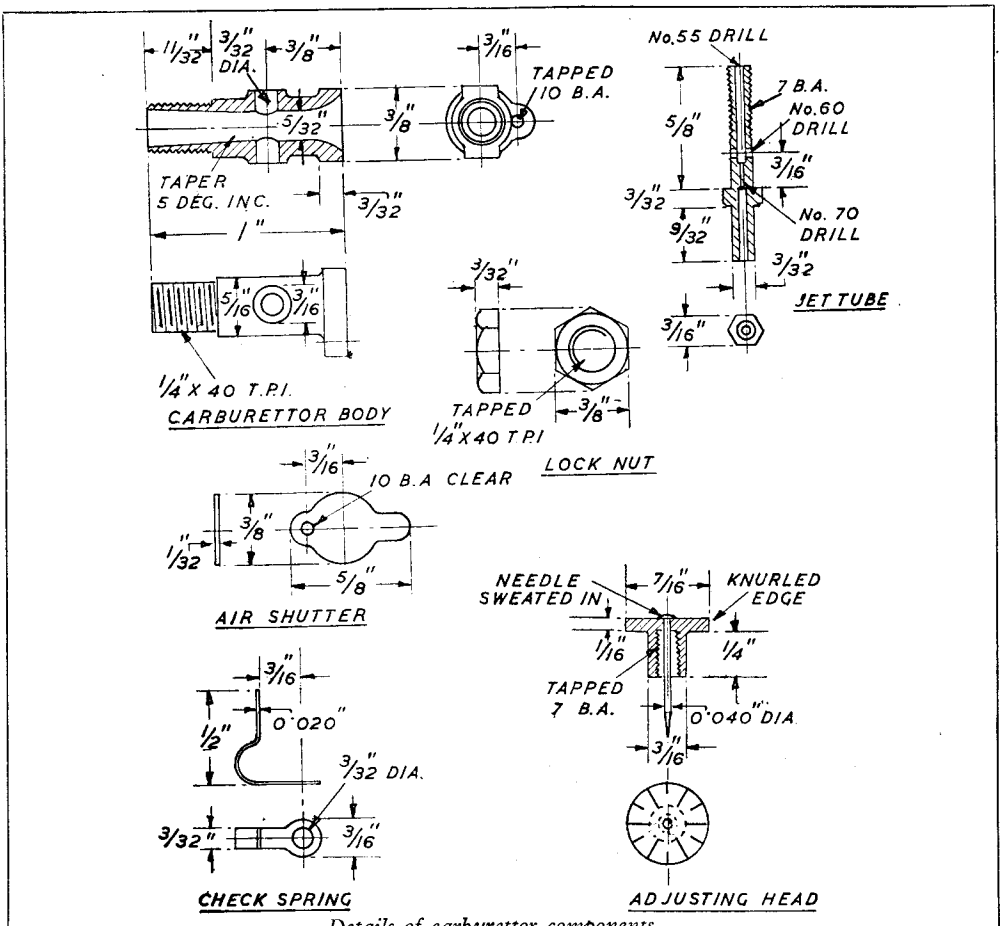
At this stage it is advisable to check up the clearance of the rods at all points of rotation, as it may possibly be necessary to file out the clearance grooves in the body to allow them to pass at the maximum angular positions. The pistons should then be assembled on the rods and the cylinder liners inserted in the body casting, after which another check should be made by rotating the shaft through a full revolution to make certain nothing is fouling.

Before bolting on the sump, the centre bearing should be turned so that its joint coincides with the crankcase joint line, and after the sump is attached, the locating hole in the lower half of the bearing should be spotted through from the hole in the sump. This will ensure that the bearing is in its correct endwise location, and not binding against the crank cheek on either side.

In the final assembly of the engine, a trace of shellac varnish or a recommended jointing preparation should be applied to all the joint faces, no other jointing material being necessary if the machining and finishing methods have been properly carried out. I have seen copal varnish or japan gold size recommended as jointing preparations, but would point out that these and similar vegetable-oil base substances are *not* fuel-resistant, and may further be subject to weird chemical reactions, to the general detriment of the fuel, lubricant, or light alloys in the engine.

This engine is a consistently good starter, and runs well with any of the c.i. engine fuels so far tried. I am not making any claims as to its power, but have little cause for dissatisfaction in this respect. Quite possibly the port areas and timing might be capable of improvement, but I have played for safety in this respect, and it would call for long and careful research to obtain

(*Continued on next page*)

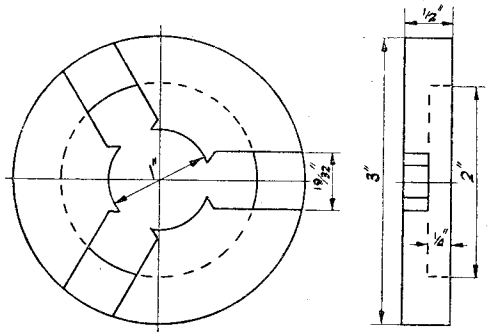


Details of carburettor components

A Grinding Jig for a Three-jaw Chuck

by E. Trotter

SOONER or later, the best of three-jaw chucks lose their original accuracy and it becomes necessary to insert thin strips of packing under one or two of the jaws for the work to run truly. This is sometimes a nuisance and it was to obviate such packing that the simple jig I am about to describe was made.



To begin with, it is necessary to decide what diameter of work is most usually held in the chuck. In my case I considered ¾ in. would be a good average and would enable a ½-in. diameter grinding wheel to be used to true up the jaws. The accompanying drawing gives the principal dimensions of the jig, and the machining operations are as follows :—

A mild-steel disc 3 in. diameter and a little more than ½ in. thick is mounted in the lathe and faced on one side. Reverse the disc in the chuck and turn a recess 2 in. diameter and ¼ in. deep in the other side. Face off the remaining ½-in. wide ring.

Remove the disc from the chuck and mark off on the flat side the outline of the slots which are to fit over the jaws of the chuck to be trued. Replace the disc in the lathe and bore the centre hole.

Mount the disc on the vertical slide with the marked-out face towards the mandrel and mill out the slots with and end-milling cutter, taking care not to cut into the small lugs at the inner end of the slots. Finish off the lugs to the scribed outline with a small file. For the sake of appearance, the rim of the disc may now be turned, holding it in the lathe by means of the recess. The jig is now finished.

In use, the jaws of the chuck it is desired to correct are opened sufficiently to allow the jig to be fitted over the jaws with the slotted side towards the chuck body. The back of the ring portion of the jig will rest against the vertical face of the second step of the jaws.

The chuck is now tightened on to the lugs, which will allow the inner faces of the jaws to stand clear of the jig in the centre hole. When the jaws are tightened, it is of no consequence if the jig runs slightly out of truth so long as it is certain that each jaw is pressed against the lugs by the scroll of the chuck.

The inner faces of the jaws may now be ground by means of a grinding-head mounted at centre height on the cross slide. No more should be ground away than is necessary to form a bright face along the full length of each jaw.

Petrol Engine Topics

(*Continued from previous page*)

the very best possible results under all conditions of working.

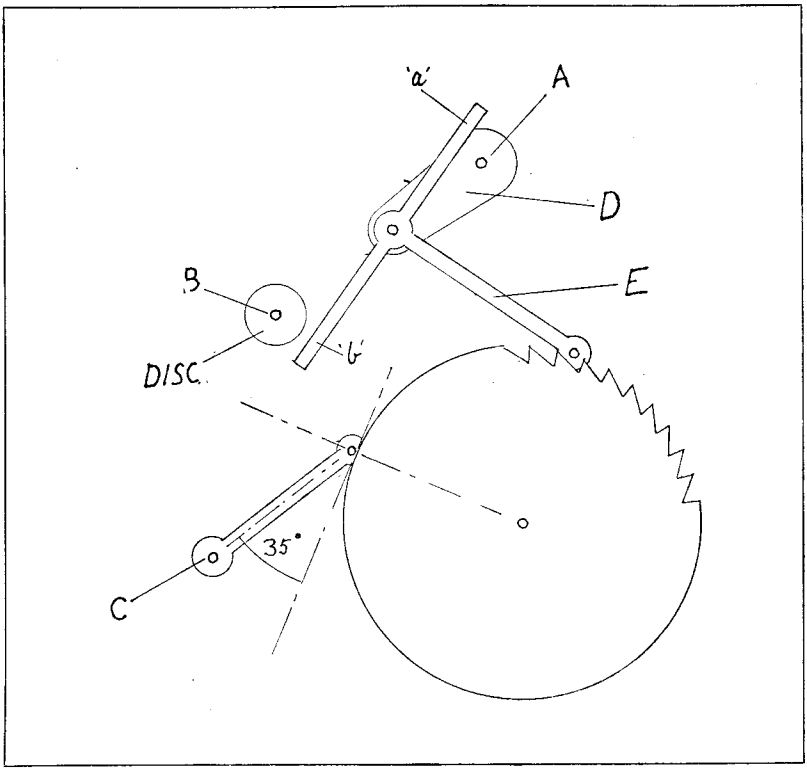
Some readers have suggested modifying the design to use it as a spark-ignition or glow-plug engine, which of course is quite possible, and the necessary alterations are fairly obvious, though I will give some particulars of them if desired. To those who have suggested a larger version of the engine (say 10 or 15 c.c.) for use in racing boats, I am quite willing, but would like to be sure which size is likely to be more popular.

There is one very interesting possibility in the adaptation of this design which, so far as I am aware, has not been attempted before, and some readers may be pleasantly surprised, and others shocked, at the suggestion. This consists of using the main castings and most of the essential working parts, to produce a STEAM engine! I have worked this scheme out in detail, but obviously it is out of place to discuss it under the present heading; readers may, however, expect to see it in due course in the series of articles on utility steam engines.

As usual, a reader wants to know whether there is any significance in the name applied to this engine. Well, a ladybird is a dainty little creature, and a formidable enemy of pests. *Verb. sap*!

A Positive Ratchet-feed for Electric Clocks

by Edwin Everett



MAKERS of electric pendulum-driven clocks may be interested in this improved ratchet-feed or " escapement." Its purpose is to ensure that the pawl always gathers one tooth yet never more than one, no matter how great the arc of swing.

In the drawing, *A*, *B* and *C* are pivoted between the plates, *D* is one of two cranks between which the pawl *E* is pivoted, while the count wheel, like the remainder of the train, is pivoted between the plates.

It will be seen that when the crutch arbor *A* has turned anti-clockwise sufficiently to advance the count wheel one tooth, the arm *a* will strike the arbor and further movement will lift the pawl out of engagement.

Movement of the crutch arbor clockwise will bring the pawl pin down on to the count wheel and trail it over one tooth, when arm *b* will strike the small disc on arbor *B*, again lifting the pawl out of engagement. The action is very fascinating to watch.

The pendulum should be arranged to feed a complete tooth at a very small arc of swing so that, in use, a decrease from the normal swing will not result in failure to gather a tooth.

The extra friction involved is small and is only that resulting from the arm *b* rolling the disc arbor in its bearing pivots.

The type of pawl shown, using steel pins to engage the wheel teeth, may be used with ordinary coarse pitch clock gear-wheels, provided the pawl does not lie at too acute an angle to the circumference of the wheel—about 35 deg. is the best.

If a three-quarter second pendulum is used, a movement with a 40-tooth wheel on the seconds-hand arbor is suitable, and if available, two or three similar 40-tooth wheels may be fitted to the arbor with the teeth (and spokes) coinciding, to provide a larger wearing area.

The layout is pleasing, the crutch arbor lying immediately above the count wheel, and the pawls engaging without need for springs or counterweights. A counterweight is, however, desirable on the crutch arbor, because of the weight of the cranks and pawl, but anyone interested in extreme accuracy will realise that the weight necessary to offset this will be a very variable quantity and that an approximation will be the best that is likely to be achieved. Such a pedantic observation is, however, entirely out of place, since the device is intended to assist the amateur to obtain successful results with a very simple type of clock.

Steam Brake for the "Minx"

by "L.B.S.C."

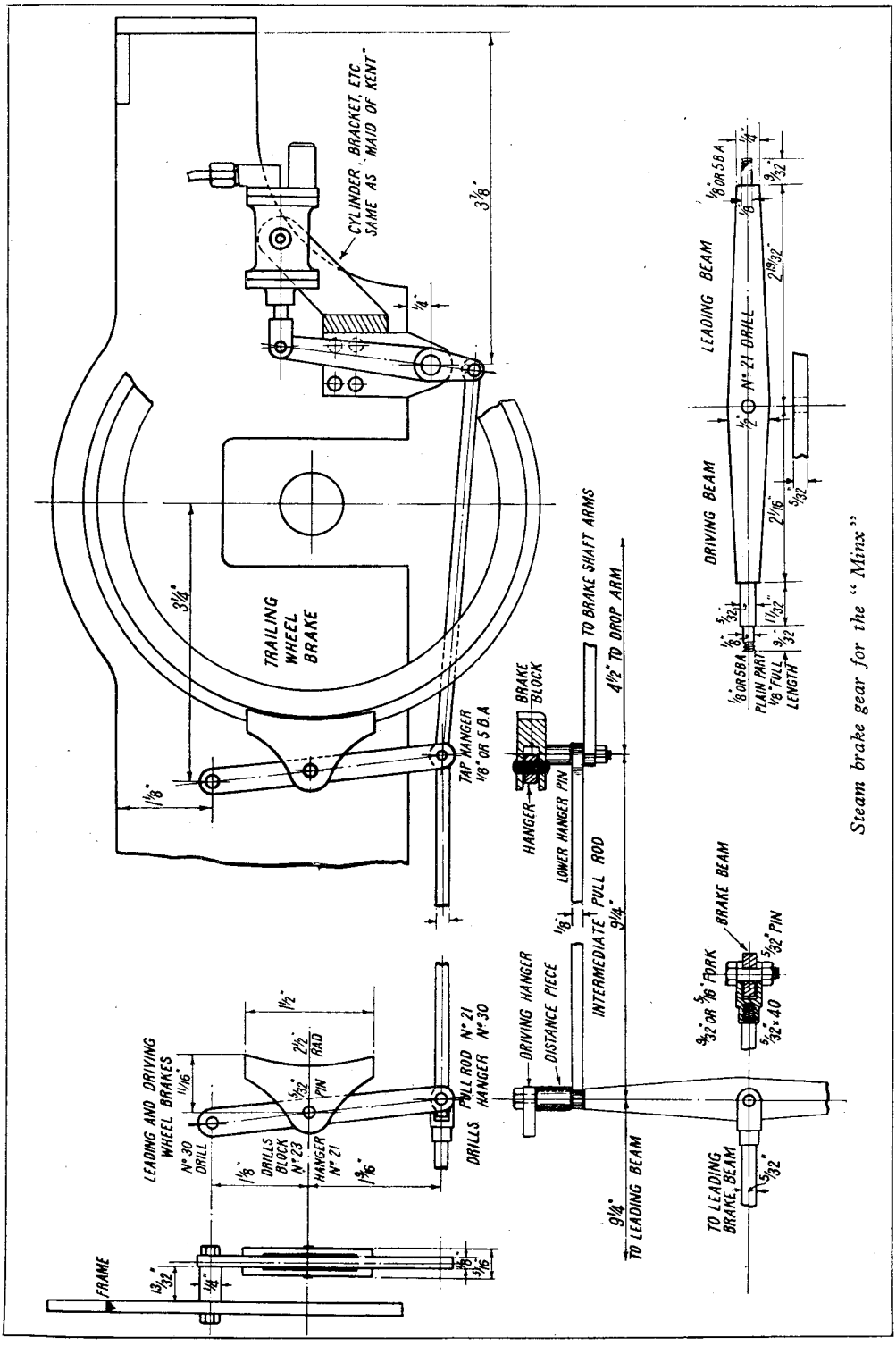
WHEN giving the description of the steam brake apparatus for the "Maid of Kent," I mentioned that a similar outfit would be suitable for the "Minx"; and if you take a look at the reproduced drawings, you will see the family likeness. Very little additional instruction should therefore be necessary. The bracket, brake cylinder, cross shaft, power lever, and drop arms are made up as a single unit exactly as described for the "Maid"; a similar pair of pull rods are attached to the drop arms, but they are 4½ in. between centres. As the coupled wheels are smaller, and the frame much nearer rail level, the bracket assembly will have to be set higher in the frame; so set it with the brake shaft centre ¼ in. below the bottom edge, and 3⅞ in. from the back end of the frame, just ahead of the drag beam. The first screwhole each side is drilled 1⅜ in. behind the vertical centre line of the trailing axle, the second ½ in. behind it, and the other two ¼ in. above them; no "mike" measurements are necessary.

The pull rods between the driving and trailing hangers are made the same way as the "Maid's," but are 9½ in. long between centres of eyes. The hangers themselves, also the brake blocks, are a little different in size and shape. The blocks are the old "Brighton" type, symmetrical in form, same width at top and bottom, instead of being irregular, like those of the "Slow, Easy and Comfortable" road. Incidentally, that nickname was by way of being a libel, for on many occasions, old Jimmy Stirling's Class "F" seven-footers, and Harry Wainwright's glamour girls of Class "D" evened out the miles and minutes between Tonbridge and Ashford. The Chatham section wasn't behind, either! On one occasion, an old rebuilt Kirtley 4-4-0 failed at Faversham with a Ramsgate-Victoria train. As luck would have it, one of the Class "C" 0-6-0 goods engines was there at the time, and this was hastily pressed into service to take on the express. She was in good fettle, and the driver, who was a bit of a speed-merchant, let her go—and go she certainly did, at one favourable stretch touching 72 miles per hour. As luck would have it, there happened to be a member of the stop-watch fraternity on the train, and he absolutely went into ecstasies of delight over this, duly reporting it in the columns of a well-known semi-technical journal, as an example of "enterprise" on the part of the driver. However, there was another person who didn't look at it in that light! It so happened that the late Mr. Maunsell read that particular article, and from a C.M.E.'s point of view, the idea of knocking 72 m.p.h. out of a five-foot wheel was more like wanton and reckless driving, than so-called "enterprise"; so he found out who the culprit was, and gave him a fortnight off, in which to cool down a bit. Your humble servant would have done the same. I'd be quite happy doing two miles per minute on an engine built for speed, like a full-sized "Tugboat Annie" or a modernised "Grosvenor"; but I wouldn't try to thrash a short-legged pony around the Epsom racecourse in an endeavour to make it run like a Derby winner. It was a good job the said driver didn't try it on with one of our "Vulcans," or bits of it would have been falling off all the way from Faversham, to the spot where she would have finally collapsed into a heap of old iron! After every Bank Holiday in the old days, we used to reckon there were enough bits lying around between London and the South Coast, to build another engine—'nuff sed!

Front End Differences

Both the brake blocks and hangers are machined and fitted, same as those on the "Maid," but the hangers are easier to make, being a regular taper. They can be filed up from $\frac{5}{16}$-in. by ⅛-in. steel strip. The brake block pins are 5/32-in. silver-steel; all the top hanger pins, and the bottom pins of the trailing hangers, are the same as those on the "Maid." The holes in the frame, for the top hanger pins, are located 3¼ in. ahead of each axle, and 1⅛ in. from the top of frame, as shown in the accompanying illustration. The middle pins can be lock-nutted, but not the others, on account of the cylinders and firebox. Tight-fitting screwed ends to the pins will do here, as the brakes are really more for ornament than use. It would, of course, be simple enough to rivet flanged bases to the frames, before erection, in which substantial pins could be carried, able to stand up to anything the brake cylinder could give them; but if the brakes are used for service stops, it won't be long before you get flats on the wheel treads. It is far more satisfactory to follow full-size practice, and utilise the weight of the train for stopping purposes. In case of an emergency stop, to avoid accident, the steam brake could be used to assist.

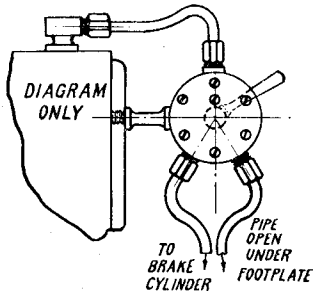
In place of the tie-rod connecting the "Maid's" driving wheel brake hangers, a regular flat tapered beam is used, connected by a central pull-rod to a similar beam between the leading pair of hangers. Each beam is made from a 5¾-in. length of ⅛-in. by 5/32-in. flat steel. This is chucked truly in the four-jaw; the ends of the driving beam are turned exactly the same as the ends of the "Maid's" tie-rod. The ends of the leading beam are turned down to ⅛ in. diameter for a length of 9/32 in., and screwed, so that when the nut is tight at the end of the thread, the hanger is free to move, without being slack. Inspector Meticulous will doubtless tell you that in full size, the hangers are not kept in place by nuts, but by washers and flat split cotters. Well, if anybody likes to fool around fitting flat cotters, which require slotted



Steam brake gear for the "Minx"

holes through a $\frac{1}{8}$ in. diameter beam spigot, he is perfectly welcome to carry on with the job; but they are not so strong, and will give inferior results to the nuts, on a little engine intended for real hard work. The beams can be milled or filed to the shape shown.

To erect, the beams are attached to the hangers, as described for the tie-rod on the "Maid of Kent," but are connected by a piece of 5/32-in. round steel rod with a fork screwed on to each end. These forks are made from 9/32-in. or $\frac{5}{16}$-in. square steel, by exactly the same process described for valve-gear forks. Beginners shouldn't forget that the cross-hole should be drilled *before* slotting; the drill doesn't, in that case, have a chance to wander off the straight and narrow path, as it sometimes does when a fork is drilled *after* slotting. It goes in one side square, and comes out on the other lopsided, as the kiddies would say. When the pull rod is finished, with the forks tightly screwed on, the distance between the centres of the holes should be $9\frac{1}{4}$ in. The forks are coupled to the beams by



How to erect the driver's, brake valve

little bolts, made from 5/32-in. silver-steel, shouldered down to $\frac{1}{8}$ in. or 5-B.A. at each end, and furnished with ordinary commercial nuts. Note—"precision-fit" joints are not necessary in brake gear. The pins should be easy in the holes; not flopping about, naturally, but easy enough to allow a spring of moderate strength, in the brake cylinder, to release the brakes as soon as the driver moves his handle to the "off" position, and mention of the driver's handle brings us to the next job, which is—

Driver's Brake Valve

A few of our readers who don't happen to have asbestos fingers, say that with the usual simple type of brake valve, in which the valve itself is a grooved plate working over a portface, similar to a regulator valve, they find it uncomfortable when steam leaks out between the working faces. Well, that is simply due to untrue working faces, or a spring that is weak; but to overcome this complaint, I schemed out the brake valve shown in the illustrations. In this one, the valve is entirely enclosed, and operated by a spindle working through the port face. There is no risk of superheated fingers, as the steam pressure is on the outside of the valve, instead of between the faces. It can be made from a bit of 1 in. round bronze or gunmetal rod, or from a bit of cast bar a little larger in diameter, to allow of finishing to 1 in.

Make the body first. Chuck the bit of rod, and if a casting, turn down about $\frac{3}{8}$ in. length to 1 in. diameter. Face the end, centre it, rather deeply, and drill down to $\frac{3}{8}$ in. depth with No. 41 drill. Part off at $\frac{1}{4}$ in. from the end. On the faced end, scribe a circle $\frac{7}{16}$ in. diameter, and scribe a straight line right across the middle of it. Centre-pop the top intersection. At 7/64 in. each side of the bottom intersection, make two more centre-pops. Drill all three halfway through the block, with 3/32 in. or No. 42 drill. Drill three No. 30 holes in the edge, to meet these holes, as shown in the section, and tap them 5/32 in. by 40. Fit a $\frac{1}{4}$ in. by 40 union screw in each hole; make them by the same process described for boiler fittings. You can either screw them in as shown, or leave the holes untapped, turn the spigots of the union screws to suit, press them in, and silver-solder them; the choice is your own. Drill another No. 30 hole in the edge, about $\frac{1}{4}$ in. deep, and tap it 5/32 in. by 40, for the fitting by which the valve is mounted (see diagram showing erection). Finally, true up the contact face by rubbing on a piece of fine emerycloth, or similar abrasive, laid on something true and flat, such as the lathe bed or drilling machine table.

Circular Valve and Cover

To make the valve, chuck a piece of $\frac{5}{8}$ in. round bronze or gunmetal rod, or turn down a piece the nearest size larger that may be available. Face the end, centre deeply, and drill No. 48 for about $\frac{1}{4}$ in. depth. Tap 3/32 in. or 7-B.A., and part off a full $\frac{1}{8}$ in. from the end. Scribe a $\frac{7}{16}$ in. diameter circle on this, and two lines across it at right angles. Don't make the scratches too deep, as they are to be made on the working face. Now follow very carefully: at the top intersection, drill a 3/32 in. or No. 42 hole right through. At 7/64 in. each side of the bottom intersection, drill two 3/32-in. holes *halfway* through, and chip a groove between them, so that the "depressions" are connected. Now take a good look at the "brake on" and "brake off" diagrams, and recollect that *you are not looking at the working face of the valve, but the back*, so that the steam port and steam slot have to be on the opposite side. Bearing this in mind, and looking at the working face, drill a 3/32-in. hole clean through, at the *right-hand* intersection. At 7/32 in. to the *left* of the top hole, on the $\frac{7}{16}$ in. circle, drill another 3/32 in. hole right through, and connect the two by filing away the metal between, leaving a sausage-shaped slot—another job that an Abrafile can do like winking. True up the valve, same as the portface, and then screw in a piece of 3/32-in. rustless steel or bronze wire, $\frac{13}{16}$ in. long, with $\frac{1}{8}$ in. of thread on the valve end, and $\frac{1}{4}$ in. of thread on the outer end.

For the cover, chuck the 1 in. rod again; and in the end, form a recess $\frac{11}{16}$ in. diameter and $\frac{3}{16}$ in. deep. The easiest way to do this, if you

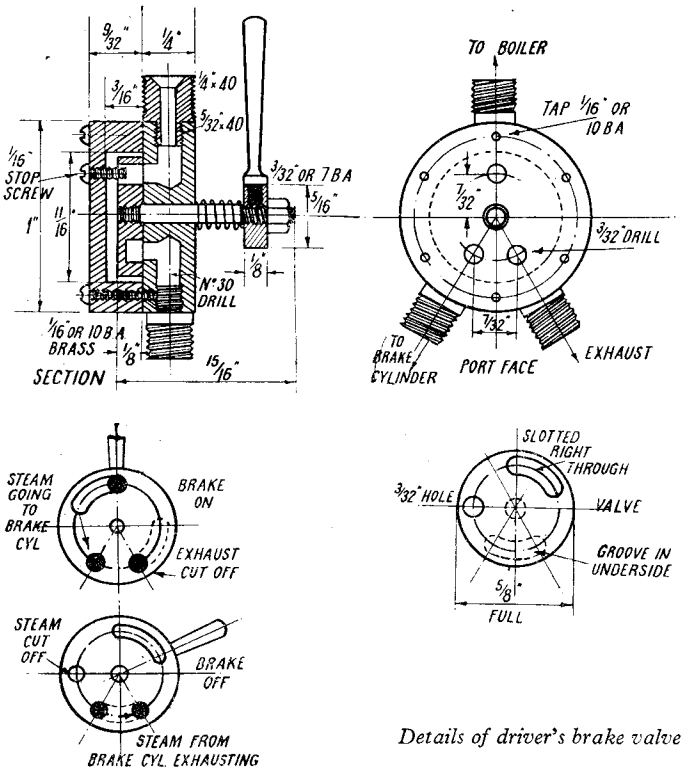
have the needful, is to start the hole with a $\frac{3}{8}$-in. drill (centre in the usual way, but not too deeply) enlarge with an $\frac{11}{16}$-in. drill, and finish off with a D-bit; otherwise, cut out as much of the recess as you can, with a roundnose tool set crosswise in the rest, and finish with a knife tool likewise. Take a skim off the face to true it up, and part off a full 9/32 in. from the end. At 5/64 in. from the edge — that is, in the middle of the contact flange—set out and drill the six screwholes, using No. 51 drill. Choose which one is going to be "top dog"; and directly underneath it, $\frac{3}{16}$ in. below, drill a No. 55 hole and tap it 10-B.A. for the stop screw, as shown in the section. Now fit the cover to the body, exactly the same as you would fit a cylinder cover, using the holes in the cover to guide the drill when making countersinks on the port face. Drill the countersinks No. 55, tap $\frac{1}{16}$ in. or 10-B.A. for the fixing screws, and finally give both portface and cover a final rub on the emery-cloth, to remove all traces of burring.

Handle and Assembly

Chuck a piece of $\frac{5}{16}$ in. round rod in three jaw, and face the end. Centre, drill No. 48 for about $\frac{1}{4}$ in. depth, tap to suit valve spindle, and part off a full $\frac{1}{8}$ in. from the end. Drill a No. 53 hole in the edge, and tap 9-B.A. Turn up a little handle from a bit of $\frac{1}{8}$-in. nickel-bronze rod and screw the end 9-B.A.; a kiddy's practice job that needs no detailing. Now put a spot of cylinder oil on the valve and port faces, poke the spindle through the valve body, and put on a spring wound up from 22-gauge tinned steel wire. Screw the handle into the boss, and screw the boss on to the spindle; when it is right at the end of the thread, the handle should be in the position shown, in relation to the ports in the valve, as indicated in the on-and-off diagrams. When the handle is vertical, the steam port in the valve should be in line with the port which leads to the steam pipe going to the brake cylinder. Now fit the cover to the valve body by means of six brass screws, roundhead or hexagon for preference, putting an oiled paper gasket between the contact faces; put in the stop screw, of similar type; put a commercial locknut on the spindle, to prevent the boss of the handle slipping back, and Bob's your uncle.

The action is as follows. When the lever is vertical, steam from the boiler comes out of the top port through the sausage-shaped "thoroughfare" slot, and fills the recess. As the circular steam port in the valve is then line-in-line with the hole leading to the brake cylinder steam pipe, steam flows down it to the brake cylinder, blows out any condensate water that happens to be in it, closes the drain valve, and pushes out the piston, which then plonks the brakes on via the power lever, drop arms, and pull rods. The pressure can be graduated by careful manipulation of the lever; and by pulling it back a little, the steam port can be closed without opening the exhaust port, thus holding the brakes at any desired tension. To release, the handle is pulled back to the position shown in the "off" diagram. The groove in the underside of the valve, then bridges the brake pipe hole and the exhaust hole, allowing steam in the brake cylinder to escape via the groove into the atmosphere, the spring in the brake cylinder returning the piston to its as-you-were position, and releasing the brakes. As the "thoroughfare" slot is always over the steam inlet hole, whatever the position of the lever, the recess is always under pressure; and even without the spring on the spindle, the valve would remain on the portface, and keep tight. The spring is fitted mainly for the purpose of keeping the faces in contact, therefore excluding grit and scale, when there is no steam in the boiler.

The stop screw should just project into the "thoroughfare" slot, as shown in the section. It is then normally impossible to move the lever farther than necessary for the full-on and full-



Details of driver's brake valve

release movements; and the screw serves a double purpose, inasmuch as by temporarily removing it, a drop or two of cylinder oil can be squirted into the recess. This not only lubricates the valve, but any surplus is blown down the pipe into the brake cylinder, and keeps the piston and packing in good trim. The absence of ugly stops screwed into the casing on the outside, makes the fitting look neat and "enginelike."

How to Erect the Valve

As long as the pipe connections are made as shown in the diagram, it doesn't matter a Continental where you fix the valve; the position you fancy, is as good as any I might specify. However, a handy place for it, is just clear of the backhead, in the position occupied by the vacuum brake ejector on the "Maid's" big sisters, the Southern L1's. To erect thus, turn up a little fitting like a piston-valve, or leave it plain if you like, but screw it 5/32 in. by 40 at both ends. One end is screwed into the blind hole in the valve body, and the other into a tapped hole in the boiler backhead, between the whistle pipe and the steam gauge syphon. A small elbow fitting with a $\frac{1}{4}$ in. by 40 union screw, is made and screwed into the wrapper as near to the top as possible; this is merely a bit of $\frac{1}{4}$-in. round rod, screwed at the end, countersunk, and drilled similar to the union fitting on the brake cylinder. A stem, similar to that on the whistle turret, is silver-soldered into the side; quite a short one will do. This fitting is connected to the top union of the brake valve, by a piece of $\frac{1}{8}$ in. thin-walled pipe, with union nuts and cones at each end.

The lower union nearest the boiler, is connected to the union screw on the brake cylinder by a similar piece of pipe, with nuts and cones; and to allow for the slight movement of the cylinder, it should have one complete coil in it, just above the cylinder. Quite a small coil will do, as the movement of the cylinder is very small indeed. A short piece of pipe is connected to the remaining union on the brake valve, and led down to the underside of the footplate, the end being left open; the two pipes can be bent to the shape of a jockey's legs, as shown, and they can keep each other close company until the exhaust one stops short. Well, I fancy that settles the question of engine brakes.

The Tamworth Exhibition

THE first "Centre of England" exhibition of the Tamworth and District Model Engineering Society was held recently in the Assembly Rooms, Tamworth, and proved a bigger success than the exhibition committee expected.

Congratulations were received from every quarter; many visiting secretaries were so pleased with the show plan and layout that they asked permission to borrow ideas; many other satisfied patrons have since sent us good wishes and donations.

During the three days, upwards of 4,000 people visited the hall, many returning several times; this kept us all very busy answering questions from curious and interested visitors.

The exhibition was opened by Mr. J. H. Black, a local industrialist, and a member of the society. Mr. Black, who is a modelmaker of some repute himself, was delighted with what he saw during his preview of the show.

The judges—Mr. F. A. A. Pariser, Mr. F. Dallaston and Mr. Howard Boys, carried out the very difficult task of sorting out the prizewinners from 17 classes, to the satisfaction of most competitors. The judges all acclaimed that the detail and finish of the model chosen was in each case excellent.

The total number of models was approximately 300, and space will only allow mention of a few prominent prizewinners. Chief among these was Mr. W. M. Smith, of Derby, who carried off a first with his $7\frac{1}{4}$-in. gauge "Midge," a very fine job. He also took a first in the General Engineering Class with his "M.E." projector. Mr. J. Brown, a club member, was awarded a first in Class 4 for his $\frac{3}{4}$-h.p. gas engine; this model also earned for him the President's Prize. Another club member to win a first in open competition was Mr. S. Jones with his "M.E." drilling machine. In the Art Section Mr. D. L. Butcher had no difficulty in adding to his prize-list with his 15th century suit of armour. In the open aero section, Mr. J. Carter, Jnr., a club member, took a first in the *Concours d'Elegance* with his beautiful 1914-1918 Sopwith "Camel." That concludes a very brief account of a most successful open competition section.

Many new ideas were tried out with complete success, and most of them will serve as a basis for future efforts. The most popular was the Ladies' Stand. A corner of the hall was allocated to our members' wives and friends for services rendered, to exhibit whatever they chose. There was a wide range of handicrafts, which attracted not only the lady visitors but many of our male patrons. As plenty of chairs were provided, the ladies foregathered, and someone christened it "Natter Corner"—which name stuck, much to everyone's amusement.

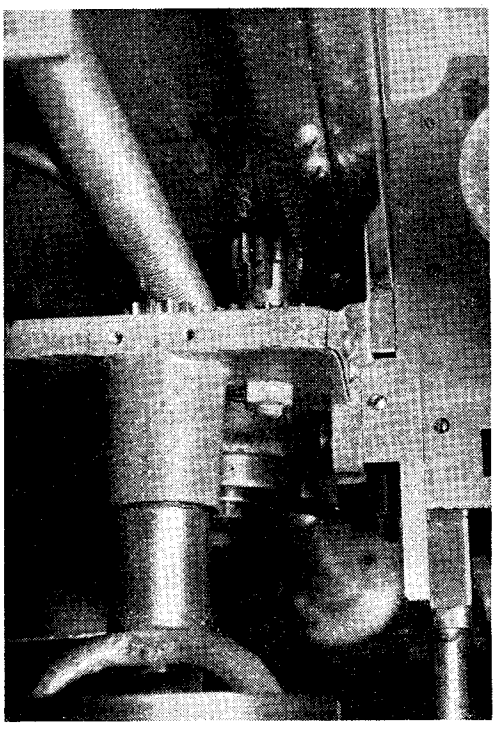
The interest shown in our jig and tool department so pleased the exhibitors that they made the club a present of a surface plate for use in the workshop.

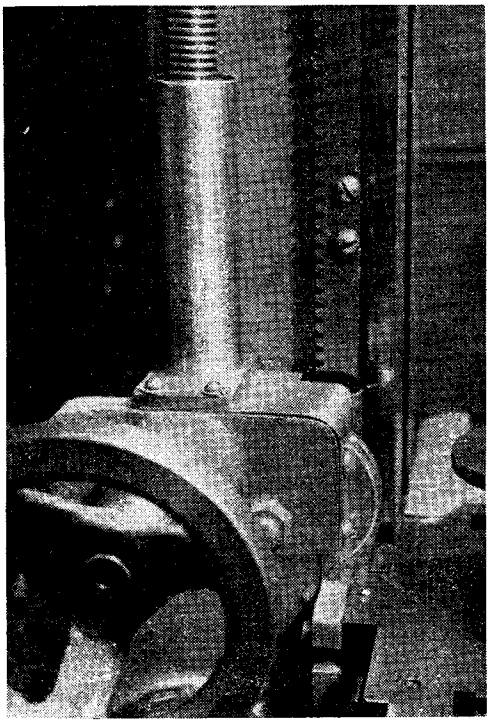
Mr. S. J. Applewhite, of Burton-on-Trent, Mr. King, of the Birmingham Club, and Mr. Williamson, of Tamworth, provided engines, track and drivers to the delight of young and old.

A programme of control-line flying and some racing-car sport was carried out by Mr. J. Carter, Jnr., and club members Mr. Buck and Mr. Parker, to the delight of a large crowd.

We are sorry it is over, as life now seems a bit flat! It is hard work organising and presenting, but none of us would have missed the experience. What a fine thing modelmaking is, and still finer is the team-spirit it encourages!—J. W. MACAULAY.

Additions to a Lathe





THE photographs of the additions to a new lathe are offered to those who, like the writer, have to make use of a workshop of the kind usually referred to as " a shed in the garden."

As nearly all such workshops suffer from damp, unless heated, and having lined walls and a floor clear of the ground, any device which will expedite the cleaning-down of machine tools prior to the necessary copious oiling after use should allow a little more time to be devoted to our hobby.

The writer found that at least fifteen minutes were required to clean out swarf which had found its way into the apron gears, clasp-nut, lead screw and cross-slide screw after a turning job occupying only a few minutes.

The lathe as supplied by the makers had no protection from swarf, other than a small plate which can be seen in photograph No. 1 at the rear end of the apron and no protection at all at the front end or cover over the lead screw.

Photograph No. 2 shows the addition of a guard made up from odds and ends of brass and $1\frac{1}{8}$-in. o.d. 18g brass tube silver-soldered together and easily removed by taking out four screws from each guard. The front apron guard is similar in construction and needs no description.

When completed, both were painted the same colour as the lathe. The aluminium cover over the cross slide can be partly seen in both photographs.

—C. L. COURT.

Activity at Weymouth

We learn that the Weymouth and District Model Engineering Society, though still in its infancy and consisting of only 14 members so far, is making excellent progress, having a project well in hand for a portable multi-gauge track. An interesting talk on road traction engines was given recently by Mr. E. G. Hobson at the society's workshop in Waverley Road, and this appears to be a subject of particular interest to the society, in view of the large extent to which traction engines and steam wagons have been used in the past in the local stone industry where some of them are still employed. The society plans to pay a visit to Weymouth lifeboat station.

*Traction Engines not so Well Known

by Ronald H. Clark, A.M.I.Mech.E.

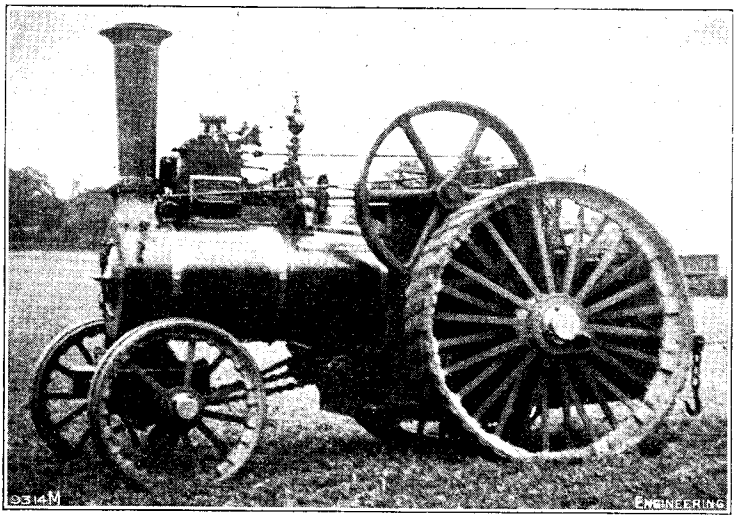


Fig. 20. 7 n.h.p. Foden double-crank compound traction engine

X—E. Foden, Sons & Co., Sandbach

Probably known to every reader on account of a most successful range of steam wagons, although their traction engines were not seen so often or made in such numbers and the production of them ceased about 1910, the first having been made in 1880. In the early days, they made the single-cylinder and duplex types and, later, a double-crank compound machine. Examples are still to be found scattered over the countryside, most of them being the later type of compounds. A typical engine is seen in Fig. 20; it was a 7-n.h.p. machine built in 1892. A large road locomotive was also produced, shown in Fig. 21, which was rated at 10 n.h.p. and weighed 17 tons. The crankshaft was very massive, being 4 in. diameter, and the pin 6 in. diameter, and the rear road wheels scaled 7 ft. 2 in. diameter × 18 in. wide. Cylinders 7½ in. and 11¾ in. × 12 in. The range of this class was from 6 to 10 n.h.p., the former having a single-cylinder 8¼ in. × 10 in. and driving wheels 6 ft. 3 in. diameter × 16 in. wide. Economy was a strong point with the compounds; one built in 1887 returned 1.84 lb. coal and 18.23 lb. water per b.h.p. per hour, respectively. 12.76 lb. water were evaporated per pound of coal. It could travel 15 miles on one tankful of water.

Most of the compounds were mounted on Foden's patent method of rear springing, outlined in Fig. 22. Here the rear axle *A* and the third motion shaft *B* are connected by two pin-jointed lever *C*, the whole sliding in the two axleboxes *D*. The upper bearings are arranged for attachment to the supporting laminated springs *E*, and all four bearings mounting the shafts *A* and *B* are of extra length and, of course, parallel and, being coupled by the levers *C* and pin-jointed each end, the rear axle and the third motion shafts can rise and fall without any locking or extra stressing taking place. In erecting the engine, the centre of the shaft *B* is set ½ in. below the centre of the second motion shaft *F*, the total vertical travel being usually ½ in., and this movement has practically no effect on the meshing depth of the gears on the two shafts concerned. The crankshaft is *G* in Fig. 22, and the spring movement of only ½ in. is just enough to absorb the worst of the road shocks and was that generally allowed by most makers.

As might be expected, a number of these large fellows were supplied to showmen and a very fine example of one of them, called *King Edward*, is seen in Fig. 23. This engine hauled a set of steam yachts about the West Midlands for many years. It has a disc flywheel, a dynamo on the smokebox extension-bracket, weighed only 10 tons and, like all others on the range, worked at 160 p.s.i.

A small tractor was also turned out in fair numbers, using the steam-wagon boiler, motion and main frames as a basis, but fitting two rear

*Continued from page 91, "M.E.," July 21, 1949.

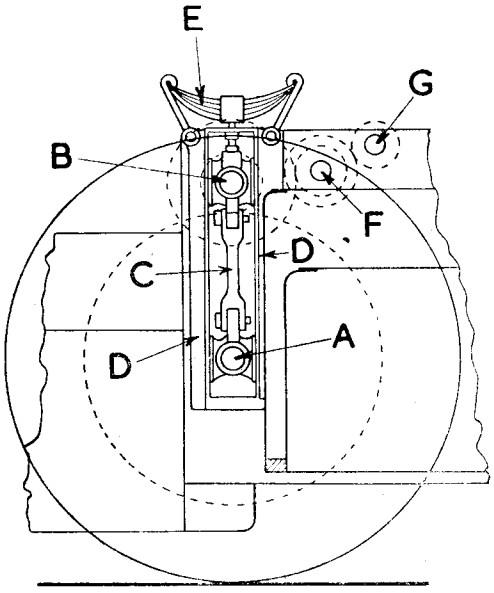


Fig. 22. Foden traction engine springing

wheels 4 ft. 6 in. diameter, the front pair being 3 ft. 2 in. diameter and all four fitted with solid rubber tyres. The rear axle mounted a winding-drum with the usual 50 yd. of wire rope. Many of these were exported to South Africa, but a few are still in use in this country, engaged mainly in timber hauling.

Note that this make of engine is easily recognisable from a distance, owing to the very large nameplate on the valve-chest cover and the great number of spokes in the rear wheels—usually over 30 of them.

XI—Fowell & Son Ltd., Cromwell Ironworks, St. Ives, Hunts

Founded by an employee of Charles Burrell & Sons, of Thetford, in 1876, C. J. Fowell appropriately enough called his works "Cromwell Ironworks" and made altogether about 109 engines, including a few portables.

I am fortunate in being able to illustrate his first traction engine in Fig. 24; it was a small machine rated at 6 n.h.p., had two speeds and, as may be expected, embodied some Burrell characteristics. Note that the cylinder and hornplates are connected rigidly, after contemporary portable engine practice.

In later years, the 6-n.h.p. size was dropped, and engines of 7 and 8 n.h.p. made entirely, having cylinders 8½ in. × 10 in. and 9 in. × 12 in. respectively. Rear wheels were 6 ft. 10 in. diameter × 18 in. wide. Fig. 25 illustrates the Show engine exhibited in 1914, and Burrell features are very apparent in the chimney, wheels, flywheel, cylinder-block and the position of the low-speed pinion, to mention but a few parts. They were all three-shaft jobs with the front axle set well back to facilitate turning into gateways, etc. These engines are double-geared on the last motion, have a differential which can be locked, and all gears of crucible cast steel. They are quite economical engines, and many owners have done a day's threshing on 5 cwt. of coal, and others can haul 14 tons on 6 cwt. a day.

Engine No. 61 of 8 n.h.p., built in 1893, was probably unique as it had an all-welded firebox, made before the present era of gas and electric welding. As Mr. Alfred Fowell told me, it was an extraordinary feat to make a box in a small works welded from the fire.

Besides the usual type of traction, Fowells made several examples of the "Box Patent Jackshaft Engine," and again I am fortunate enough to be able to illustrate one of these interesting engines from an actual photograph, seen in Fig. 26. Here, the power is taken by gearing to the "Jack" or cross-shaft (the third

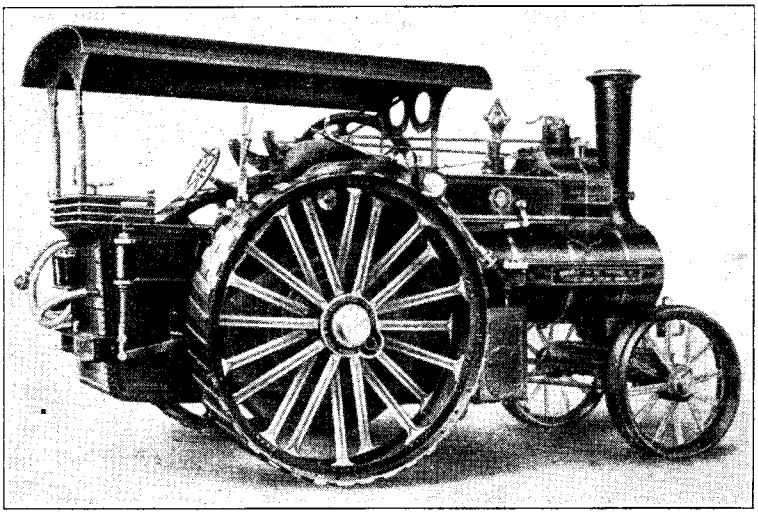


Fig. 21. Foden 10 n.h.p. road locomotive

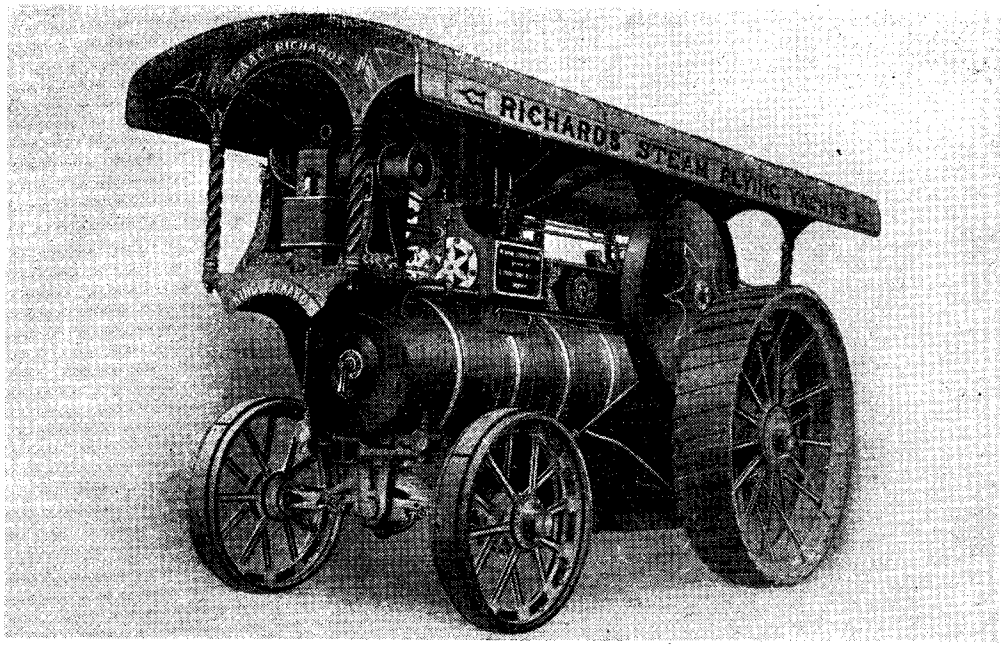


Fig. 23. "King Edward"—a fine Foden showman's engine

TABLE IV—List of FOWELL Traction Engines so far as is known.

Work's No.	Year	N.H.P.	Remarks
1	1876	6	Reputed only 6 N.H.P. made.
2	1877	—	
11	1881	8	
18	1882	8	
19	—	7	Broken up 1942.
22	1883	8	
26	1883	—	Portable engine existing 1935.
31	1885	—	Portable engine.
33	1886	—	
36	1888	—	
37	1888	8	
38	1888	8	
39	1885	—	Portable engine.
40	1887	—	Small marine engine ? Compound.
44	1889	8	
48	1890	8	
52	1891	8	
53	1891	8	
54	1891	—	
56	—	—	
59	—	—	
61	1893	8	Box welded from the fire.
63	1892	—	
64	1894	—	
68	1895	—	
70	1896	8	
73	—	—	Oil engine.
77	1895	—	
81	1896	7	
83	1896	7	
84	—	7	
85	—	7	
86	1897	8	
90	1901	7	
91	1902	—	
92	1903	—	
93	1905	—	
94	1905	—	
95	1906	7	
97	1908	—	
98	1909	—	
101	1911	—	
102	1912	8	
106	1914	8	Show engine, see Fig. 25.
107	1915	—	
108	1922	8	
109	1921	7	In regular use.

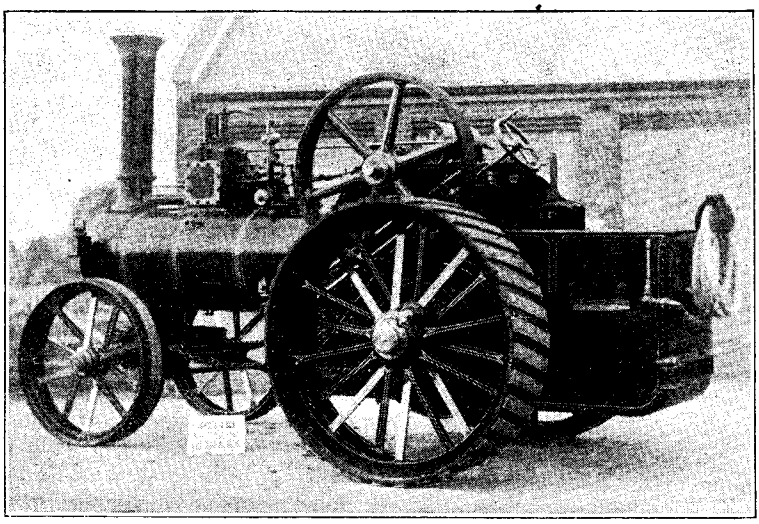


Fig. 25. Fowell show engine No. 106, exhibited in 1914

shaft) and, at each end of this shaft, there was a crank disc on which a side coupling-rod was connected to another disc on the main axle, or fourth shaft. The connection between the axle discs and the rear wheels was by means of a friction-band, so that by suitably slipping one or the other, the engine could turn sharp corners. Power was developed in a single cylinder 9 in. ×

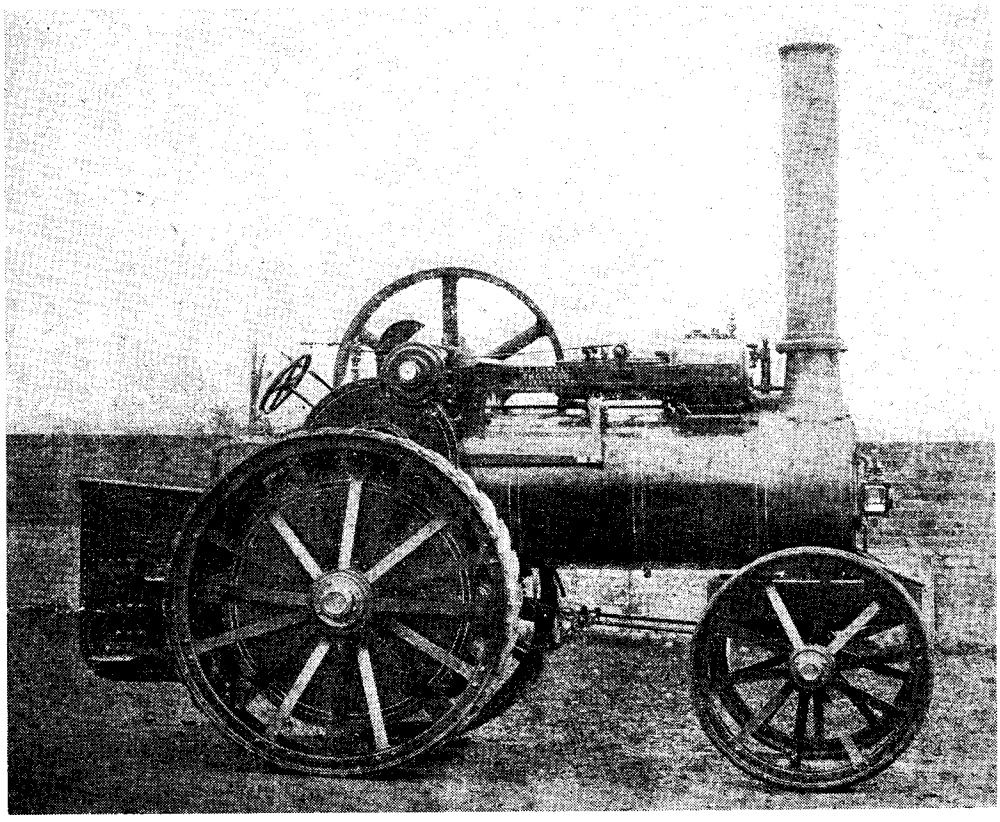


Fig. 24. Fowell's No. 1 traction engine of 1876

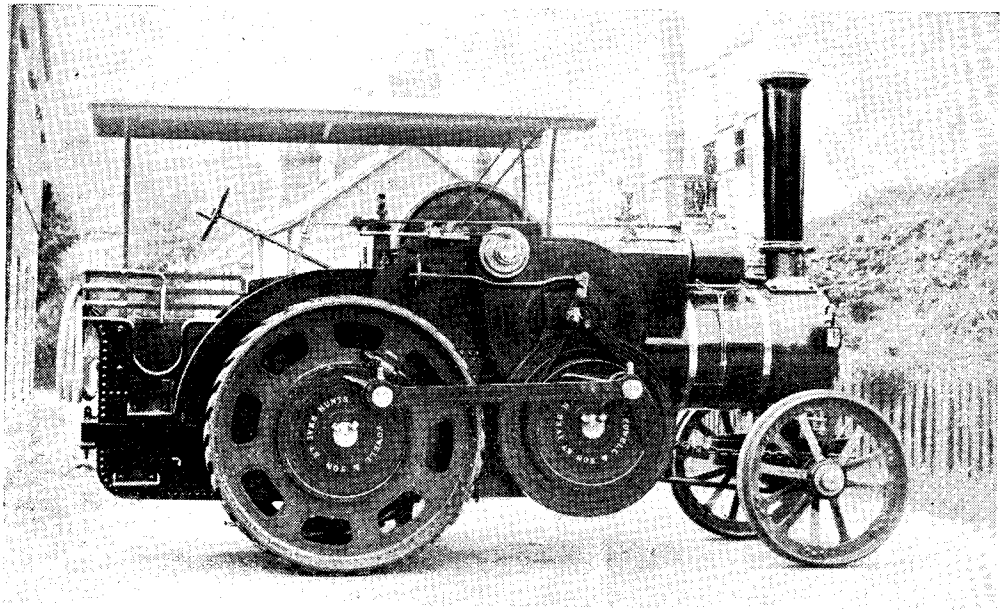


Fig. 26. Fowell road locomotive with box patent jackshaft drive

12"in. There was one of these engines in use in the Eastern Counties just after the first war, but unfortunately I never managed to inspect it.

It is interesting to note that a pre first war engine of 7 n.h.p. was listed at £465 ex-works.

Many Fowell engines are in use today and I include, in Table IV, a list of engines made a St. Ives as far as is known. One fact emerging from this list is that a lower number may have left the works before that immediately following it, due no doubt to the engine being allotted a number before manufacture.

(To be continued)

For the Bookshelf

Coachpainting, Spraying and Signwriting, by Cecil Jasper. (London : The Technical Press Ltd.) Price 7s. 6d. net.

Students and craftsmen in the art of painting private and commercial vehicles will find this book to be a practical guide to the attainment of the best results. There can be little doubt that to the non-technically-minded purchaser of motor-cars and vehicles of most types, whether at home or overseas, attractive and pleasing finish to the paintwork is of considerable importance. None but the experienced coachpainter and signwriter can be expected to achieve the desired effects, and nothing but constant practise can ensure facility in the art. How and what to practise is the main theme of this book, written in straightforward language and illustrated by numerous helpful drawings and sketches.

The Complete Handyman. (London : Odhams Press Ltd.) Price 8s. 6d. net.

This is a 576-page instructive book, profusely illustrated with sketches, drawings and photographs, and containing just the information required for doing all manner of jobs and making all sorts of useful fitments in the home, garage, workshop and garden. The general subjects covered are : woodwork, metal work, electricity, radio, house decoration and repairs, garden arrangements, working drawings and model making. Each of these is subdivided into numerous sections giving advice and instruction, simply expressed, on how to make various items of equipment without any very elaborate collections of tools. In short, the book is an excellent guide to anyone who would aspire to becoming "a handy man about the house."

PRACTICAL LETTERS

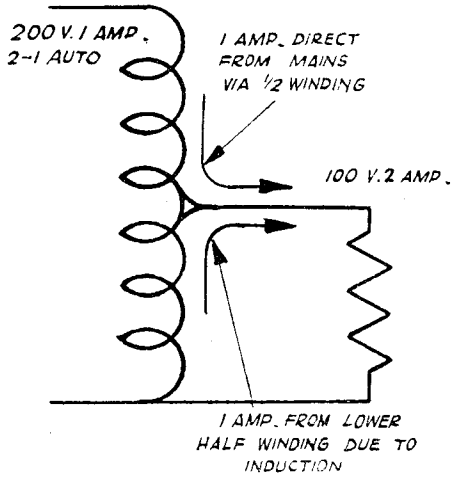
Transformer Design

DEAR SIR,—The article by A. R. Turpin in the June 23rd issue gives an incorrect method of finding the secondary mean turn length.

One method of doing this is as follows :

Length of Primary inner turn = 2(2.0) + 2(1.37) =	6.74 in.
4 times radial, depth of Primary 4(.35) =	1.4 in.
Primary mean turn	8.14 in.
4 times radial depth of Primary and Secondary 4(.35 + .375) =	2.9 in.
Secondary mean turn	11.04 in.

The reference to auto transformer is vague and in the case of 2 : 1 ratio is definitely incorrect



since the current through the whole winding is the same, as can be seen from the sketch. If the ratio of the $\frac{\text{whole winding}}{\text{tapped winding}}$ is greater than about 3 : 1 there is not much gain in using an auto and it is better to use a double wound and gain the advantage of isolation from mains. With a 2 : 1 auto, about double the wattage can be handled for any given core size as against a double wound, so the formula $A = \frac{\sqrt{WP}}{5.75}$ will give a core needlessly large.

Yours faithfully,

Chorley. R. S. HATCH.

Fowler Engines

DEAR SIR,—I was rather interested in Mr. R. C. Stebbing's letter in June 9th issue of THE MODEL ENGINEER, and think that he will be interested in the undernoted particulars given to me by friends who at one time were on the executive staff of Messrs. Fowler's, Leeds.

Both the Fowler's engines 16719 and 16491 are of the Z7 type, the former being built in 1926 and sold to Concrete Aggregates Ltd. ; the latter was built in 1925 and was sold to G. Cauldwell, a well-known agriculturist in Lincolnshire. Both engines are compounds and the 9 ft. × 15 in. × 14 in. were the biggest ploughing engines ever made by Messrs. Fowler, some of these models being superheated which quite naturally gave extra power. Relevant dimensions, details, etc., are appended hereunder :—

Engine 16719

Boiler 36-2¾ in. tubes ; Cylinders HP 8 in. × LP 14 in. × 14 in. stroke ; Link motion " D " valves ; Drum gear 15 teeth into 82 teeth ; 300 yards of wire rope on 11¾ in. deep drums ; 7 ft. × 30 in. wide hind road wheels.

Engine 16491

Boiler 50-2¼ in. tubes ; Cylinders HP 9 in. × LP 15 in. × 14 in. stroke ; Firths valve gear and piston valves ; Drum gear 15 teeth into 95 teeth ; 900 yards of wire rope on 14 in. deep drums ; 7 ft. × 30 in. wide hind road wheels ; Pickering governors fitted.

Yours faithfully,

Leeds. J. E. JOHNSON.

An Old Pumping Engine

DEAR SIR,—I am rather interested in an old type of pumping engine which I have seen working here in Staffordshire quite recently. As I would like to learn more about this particular kind of engine, I should be glad to know if any reader has been in closer contact with this type of engine, and would perhaps give me a little information on it.

The engine referred to was made by Hawthorn Davey & Co. Ltd., of Leeds, about 50 years ago. It is a tandem compound, the cylinders being steam jacketed with a tail-rod mounted behind the L.P. The stroke is 7 ft., but I do not know what the bores are.

As this engine has no crankshaft, the valve-gear is actuated by a " cataract," consisting of two cylinders about 10 in. bore, one being supplied by steam from the H.P. chest and the other seems to be a dashpot, like those seen on engines which are fitted with Corliss detaching valves.

So far as I could see, this cataract also works the air pump and circulating pump for the condenser, which is below the engine room floor. This, by the way, is a surface condenser, containing some 500 ⅝ in. brass tubes.

I would be pleased if some person could give a fuller account of this " cataract," as it is the first one I have seen.

Yours faithfully,

Brierley Hill, Staffs. C. LEWIS.